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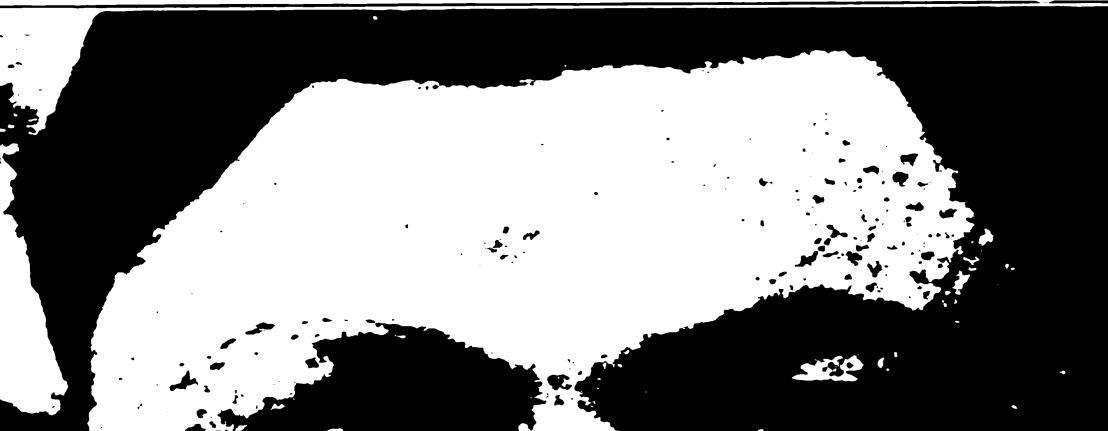
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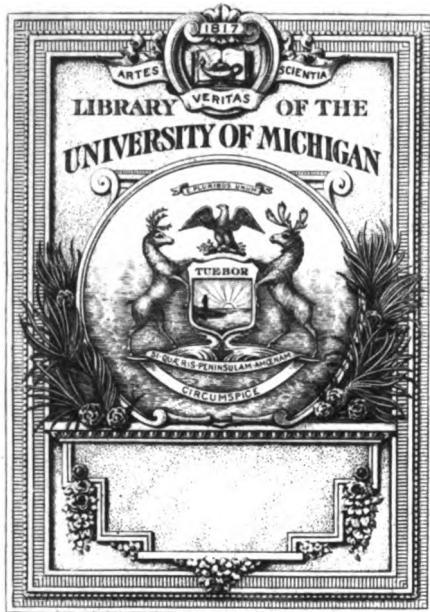
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Figure 13.



*Section on Laryngology,
Otology, and Rhinology*
American Medical Association



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TRANSACTIONS OF THE

Amer. Medical Assoc. SECTION ON

**Laryngology, Otology
and Rhinology**



of the
American Medical Association
at the Sixty-Fifth Annual
Session, held at Atlantic City,
N. J., June 23 to 26, 1914

**AMERICAN MEDICAL ASSOCIATION PRESS
CHICAGO: NINETEEN HUNDRED AND FOURTEEN**

Reprinted from
THE JOURNAL
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AMERICAN MEDICAL ASSOCIATION

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LIST OF OFFICERS

This Section was organized in 1888 (by dividing the previously existing Section on Ophthalmology, Otology and Laryngology) and has been served by the officers named below. This list has been compiled from the published records of the Association. It is possible that some errors have been made. It will be appreciated if any mistakes are brought to the attention of the Secretary of the American Medical Association.

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1889-90	Chairman, J. O. Roe, Rochester. Secretary, F. H. Potter, Buffalo.
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1899-00	Chairman, C. R. Holmes, Cincinnati. Secretary, J. A. Stucky, Lexington.
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1902-03	Chairman, George L. Richards, Fall River. Secretary, J. F. Barnhill, Indianapolis. Delegate, Norval H. Pierce, Chicago.
1903-04	Chairman, J. F. Barnhill, Indianapolis. Secretary, Otto T. Freer, Chicago. Delegate, George L. Richards, Fall River, Mass.
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1914-15	Chairman, Norval H. Pierce, Chicago. Vice-Chairman, Ross H. Skillern, Philadelphia. Secretary, Francis P. Emerson, Boston. Delegate, George E. Shambaugh, Chicago.

PROCEEDINGS OF THE SECTION

TUESDAY, JUNE 23—AFTERNOON

The meeting was called to order at 2 p. m. by the chairman, Dr. Burt R. Shurly, Detroit.

Dr. Shurly then read his chairman's address, entitled "Preventive Otolaryngology."

Dr. Joseph C. Beck, Chicago, read a paper on "Chronic Focal Infection of the Nose, Mouth, Throat and Ear."

Dr. Norton L. Wilson of Elizabeth, N. J., read a paper on "The Faucial Tonsil as a Gateway to General Infection."

These two papers were discussed together by Drs. George E. Shambaugh, Chicago; Robert Levy, Denver; George L. Richards, Fall River, Mass.; Otto T. Freer, Chicago; W. W. Carter, New York; John F. Barnhill, Indianapolis; D. J. MacDonald, New York; Thomas E. Carmody, Denver; Stanton A. Friedberg, Chicago; Emil Mayer, New York; W. E. Dixon, Oklahoma City; A. I. Weil, New Orleans; E. B. Gleason, Philadelphia; G. Hudson Makuen, Philadelphia; Harold M. Hays, New York; C. E. Cooper, Denver; Rufus B. Scarlet, Trenton, N. J.; Burt R. Shurly, Detroit; John J. Sullivan, Scranton, Pa.; Joseph C. Beck, Chicago, and Norton L. Wilson, Elizabeth, N. J.

Dr. Charles R. C. Borden, Boston, read a paper on "Latent and Tertiary Syphilis in Diseases of the Nose and Throat." Discussed by Drs. Joseph C. Beck, Chicago; W. W. Carter, New York; John O. Roe, Rochester, N. Y.; John F. Barnhill, Indianapolis; Otto T. Freer, Chicago; E. J. Bernstein, Kalamazoo, Mich.; H. Horn, San Francisco; G. Hudson Makuen, Philadelphia; P. Schoonmaker, New York; Norval H. Pierce, Chicago; L. W. Jessaman, Framingham, Mass.; Dunbar Roy, Atlanta, Ga.; Emil Mayer, New York; J. C. Beck, Chicago, and Charles R. C. Borden, Boston.

A resolution was offered by Dr. George L. Richards, Fall River, Mass., that the Board of Trustees be requested to publish the papers of the Section on Laryngology, Otology and Rhinology in the regular numbers of *THE JOURNAL*, as for the other sections, instead of in a separate edition as heretofore. This resolution was unanimously adopted.

On motion of Dr. Burt R. Shurly of Detroit the Section voted to instruct its delegate to present a resolution in the House of Delegates urging an effort to secure appropriate legislation restricting or regulating the sale of preparations

containing the caustic alkalies by grocery and other stores without proper labels warning the public of the dangerous nature of the products.

In the House of Delegates Dr. Dunbar Roy, delegate from the Section on Laryngology, Otology and Rhinology, presented the following, which was referred to the Reference Committee on Hygiene and Public Health:

WHEREAS, hundreds of children are sacrificed each year by strictures of the esophagus caused by burns from lye and other household articles containing caustic preparations, the Section on Laryngology, Otology and Rhinology hereby requests that the House of Delegates urge some legislation for the proper labeling of all cleansing preparations of a caustic character, sold by grocers and other merchants.

On this resolution the following report of the Reference Committee was adopted by the House of Delegates:

"The resolution presented by Dr. Dunbar Roy, delegate from the Section on Laryngology, Otology and Rhinology, requests that the House of Delegates urge legislation to compel proper labeling of all cleansing preparations of a caustic character and sold by grocers and other merchants. The Committee approves this resolution, and recommends its adoption, with the suggestion that it be brought to the attention of both federal and state legislative bodies by the Council on Health and Public Instruction and by the respective state associations."

WEDNESDAY, JUNE 24—MORNING

Dr. J. S. Clark, Freeport, Ill., exhibited a set of new instruments, consisting of a modification of West's set, for operating on the lacrimal sac through the nose.

Dr. Robert Clyde Lynch, New Orleans, exhibited the instruments for his new technic for the removal of intrinsic laryngeal growths, for use with the suspension apparatus.

Dr. John J. Sullivan, Scranton, Pa., exhibited a new modification of his frontal sinus rasps; also a new rasp for use in the maxillary sinus operation, and a new instrument for transillumination of the sinuses.

Dr. E. M. Holmes, Boston, exhibited a new spatula to be used with his endoscope for retraction of the palate, of service in very young children and refractory subjects.

Dr. J. A. Babbitt, Philadelph'a, read a paper on "The Reconstruction of the Nasal Septum after the Submucous Operation." No discussion.

Dr. S. P. Beebe, New York, read a paper on "The Relation of Pathologic Conditions in the Nose and Throat to the Development and Treatment of Hyperthyroidism." Discussed by Drs. Charles G. Jennings, Detroit; Otto Joachim, New Orleans; George E. Shambaugh, Chicago; John F. Barn-

hill, Indianapolis; Joseph C. Beck, Chicago; George F. Cott, Buffalo, N. Y.; Owen P. Smith, Portland, Me.; Henry Horn, San Francisco; Burt R. Shurly, Detroit, and S. P. Beebe, New York.

The following papers were read as a Symposium on the Different forms of Ethmoiditis:

Dr. E. M. Holmes, Boston: "The Clinical Classification of Ethmoiditis."

Dr. George E. Shambaugh, Chicago: "The Pathology of Ethmoiditis."

Dr. Harris P. Mosher, Boston: "Applied Anatomy and Surgical Treatment."

These papers were discussed by Drs. Ross H. Skillern, Philadelphia; Otto T. Freer, Chicago; George F. Cott, Buffalo, N. Y.; William W. Carter, New York; W. H. Sears, Syracuse, N. Y.; A. L. Burdick, Lansing, Mich.; G. W. MacKenzie, Philadelphia; Charles R. C. Broden, Boston; John O. Roe, Rochester, N. Y.; Harold Wilson, Detroit; Joseph C. Beck, Chicago; L. M. Hurd, New York; E. M. Holmes, Boston; George E. Shambaugh, Chicago, and Harris P. Mosher, Boston.

WEDNESDAY, JUNE 24—AFTERNOON

Dr. John Randolph Page, New York, read a paper on "Hemorrhage from the Superior Petrosal Sinus as a Complication in Operations on the Lateral Sinus." No discussion.

Dr. Philip D. Kerrison, New York, read a paper on "Treatment of Deafness Due to Ossicular Fixation." Discussed by Drs. J. R. Page, New York; George L. Richards, Fall River, Mass.; Norval H. Pierce, Chicago; W. S. Tomlin, Indianapolis; S. MacCuen Smith, Philadelphia, and P. D. Kerrison, New York.

Dr. Samuel J. Kopetzky, New York, read a paper on "Progress in the Treatment of Otitic Meningitis." Discussed by Drs. Norval H. Pierce, Chicago; Francis P. Emerson, Boston; S. MacCuen Smith, Philadelphia; Burt R. Shurly, Detroit; W. P. Eagleton, Newark, N. J., and Samuel J. Kopetzky, New York.

THURSDAY, JUNE 25—MORNING

The Chairman, Dr. Dunbar Roy, Atlanta, Ga., read the report of the Nominating Committee, as follows: Chairman, Norval H. Pierce, Chicago; Vice-Chairman, Ross H. Skillern, Philadelphia; Secretary, Francis P. Emerson, Boston; Delegate and Chairman of Executive Committee, George E. Shambaugh, Chicago.

The Secretary was instructed to cast the ballot for the names recommended by the Nominating Committee and they were declared duly elected.

The following papers were read as a Symposium on the Intralaryngeal Methods of Operation on the Larynx:

Dr. H. Holbrook Curtis, New York: "The Indirect Method of Intralaryngeal Operation."

Dr. Chevalier Jackson, Pittsburgh: "The Direct Method of Intralaryngeal Operation."

Dr. Ross H. Skillern, Philadelphia: "The Suspension Method of Killian."

These papers were discussed by Drs. Robert Levy, Denver; Harris P. Mosher, Boston; Sydney Yankhauer, New York; Thomas E. Carmody, Denver; E. J. Bernstein, Kalamazoo, Mich.; H. L. Lynah, New York; H. W. Ridpath, Indianapolis; Otto T. Freer, Chicago; George F. Cott, Buffalo, N. Y.; A. B. Thrasher, Cincinnati; W. B. Chamberlin, Cleveland; Burt R. Shurly, Detroit; Holbrook Curtis, New York; Chevalier Jackson, Pittsburgh, and Ross H. Skillern, Philadelphia.

Dr. Samuel Iglauer, Cincinnati, read a paper on "The Value of Radiography in the Diagnosis of Diseases of the Larynx and Trachea."

Dr. Lee M. Hurd, New York, read a paper on "Lantern Slides of Roentgenograms of the Nasal Accessory Sinuses."

These two papers were discussed by Drs. G. E. Pfahler, Philadelphia; P. M. Hickey, Detroit; E. W. Caldwell, New York; Mark D. Stevenson, Akron, Ohio; G. C. Johnson, Pittsburgh; A. I. Weil, New Orleans; Harris P. Mosher, Boston; George F. Cott, Buffalo, N. Y., and Samuel Iglauer, Cincinnati.

Dr. Harmon Smith, New York, read a paper on "Laryngeal Papilloma." Discussed by Drs. Robert Levy, Denver, and Samuel Iglauer, Cincinnati.

Dr. John L. Lougee, Boston, read a paper on "End-Results Following the Yankhauer Operation in the Eustachian Tube." Discussed by Drs. Harris P. Mosher, Boston; G. W. MacKenzie, Philadelphia, and John L. Lougee, Boston.

THURSDAY, JUNE 25—AFTERNOON

Dr. Lee M. Hurd, New York, exhibited some new hard-rubber nasal splints, which had been originally devised for use in the Asch operation, but which are now used in fractures and in cosmetic work in building up the bridge of the nose.

Dr. Hurd also exhibited an instrument for obviating the necessity of packing the nose after the submucous resection of the nasal septum. Description of the instrument will be found on page 261.

Dr. H. L. Lynah, New York, exhibited a series of tubes and photographs thereof, for intubation in the treatment of chronic stenosis of the larynx, and a new intubation speculum. For description, see page 259.

Dr. Edmund P. Fowler, New York, read a paper on "The Origin of Labyrinthine Rest-Tone." Discussed by Dr. G. W. Mackenzie, Philadelphia.

Dr. Lester M. Hubby, New York, read a paper on "Sonorous Vibrations in Ear Disease." Discussed by Drs. Walter A. Wells, Washington, D. C.; E. P. Fowler, New York, and Lester M. Hubby, New York.

Dr. E. L. Jones, Cumberland, Md., read a paper on "The Relation of the Rhinopharynx to the Middle Ear and Mastoid." Discussed by Drs. Oscar Wilkinson, Washington, D. C., and John J. Sullivan, Scranton, Pa.

Dr. Linn Emerson, Orange, N. J., read a paper on "Operations for Clefts of the Hard and Soft Palate." Discussed by Drs. G. Hudson Makuen, Philadelphia; T. F. Carmody, Denver; Oscar Wilkinson, Washington, D. C., and Linn Emerson, Orange, N. J.

PREVENTIVE OTOLARYNGOLOGY*

BURT R. SHURLY, M.D.
DETROIT

Your twenty-sixth Chairman rejoices with you in the spirit of optimism, scientific enthusiasm and progress endowed to us as a legacy from those who have so nobly guided our Section during the quarter century gone before.

It is my pleasure to extend to you the right hand of fellowship and a cordial and heartfelt welcome. You will pardon my inability to express appropriately the keen sense of appreciation I feel of the honor you have bestowed on me. I trust that in the future, time may permit me to render a full measure of gratitude by an enormous amount of long-continued and faithful work for the best interests of this Section.

It is peculiarly the function of this body to welcome the new and aspiring members of our art, and those in general practice who have a leaning or yearning toward otolaryngology. One-fifth of the members of the American Medical Association registered at the Chicago meeting were classified in the eye, ear, nose and throat sections.

We are suffering mentally, physically and financially from too many medical societies, too many new instruments and accessories and too many surgical operations with the name of the surgeon as the distinguishing pennant of the operation. It will soon be time to appoint a board of censors centrally located to which instruments and operations may be presented and which will approve those worthy of attention before the profession and public are subjected to so-called improvements.

* Chairman's Address.

The practitioner and specialist of this country is particularly distinguished for a keen uplifting interest in humanity, a broad sympathy and a devotion to the greater comfort and general welfare of the patient. It is still true, however, that the most noble and skilled exponent of our special art must pay homage and reverence to the greatest queen of all—Dame Nature; her ways of prevention, medication and cure must be ours.

The mind of the medical man in the last two decades has originated, elaborated, improvised and invented innumerable systems, methods and instruments to eliminate pathologic or other tissue from the nose, throat or ear, yet the pages of our literature on preventive methods of procedure in our specialty have been few indeed. The question of when not to operate may be uninteresting, but as a valuable consideration in the saving of life it is frequently as important in otolaryngology as in the surgery of the appendix.

It is unnecessary for us to follow the Mohammedan custom of daily chant, and open our office each day with a recital of the Hippocratic oath and ten laws of Dame Nature which must be obeyed, but it is fitting and proper that we should frequently ponder on the great and serious responsibilities of our calling. This applies especially to our overzealous radical colleagues who seem to consider surgery the only road to success. It takes a conscience, introspection, sympathy and a true sense of responsibility to realize that the limitations of one's individual surgical ability and training must be the guiding stars of decision and judgment. The value of any instrument, operation or method depends on proper selection and use.

Are we to ligate the carotid for tonsillar hemorrhage? Yes, if necessary; but if a brilliant and dexterous general surgeon is in an adjoining operating-room he should be called in as he can accomplish the work skilfully in half the time it would take a laryngologist. The old adage "An ounce of prevention

is worth a pound of cure" applies to otolaryngology and may be resuscitated at this time with advantage. Prophylaxis is the text of the dentist as he merrily bores into the decayed tooth. We hear the pathologist assert that immunity and heredity explain the problem. Eugenics will reform the world, says the pediatrician. Sanitary science, hygiene and quarantine are the interesting themes of the internist.

The subject of preventive otolaryngology may be classified to include a system of observances that will offer the best protection or prevention to the individual or community of diseases of the nose, throat or ear.

Preventive medicine will not be appreciated by the laity or profession until a secretary of public health in the cabinet at Washington shall organize, develop and promote this subject with its special branches for the benefit of humanity.

The practical importance of the prevention of disease in the upper respiratory tract and the accessory channels of the ear grows on one as it is viewed from the biologic, sociologic, pathologic, or therapeutic point of view. Under the subclassification of protective otolaryngology it is possible to accomplish much of great practical value to the community at large.

Your Chairman of 1910, Dr. Jackson, has called attention to the necessity for compulsory labeling of poisons sold by grocers. There are many preparations of caustic alkali that have been accidentally taken by children, and many hundred cases of cicatricial esophageal stenosis must have occurred through laxity in making and enforcing laws regulating the sale of poisons. Our delegate should be instructed to investigate this matter and present another resolution on this subject to the House of Delegates if necessary.

The problem of noise and its deleterious effects on the auditory nerve, and the effect of dust on the upper air-tract can be modified by passage and enforcement of sane laws.

We should join heartily in the propaganda for medical and popular education and form a society of human animal welfare that will take precedence over that organized for the dog and the automobile. When the science of prevention fully arrives, every human machine will be examined semiannually and a careful record kept in card index form about every organ in the body including the nose, throat and ear.

The greatest sign of the times that operates for the prevention of disease is the gradual elimination of medical sects and the elevating of medical educational standards. The osteopathic, botano-eclectic or homeopathic otolaryngologist has been relegated to otolaryngologic Pompeii and is now metamorphosed into a broad, liberal-minded nose, throat and ear surgeon who can think as a pathologist, internist or therapist as the occasion requires.

It is a well-known fact that abuses to the metabolic functions, though expressed in the apparatus under our special observation, will affect others through the medium of the connecting branches of the sympathetic system. The neuroses, psychoses and other disturbances of the ductless glands and vasomotor system may be prevented only by the proper hereditary development of a stable vasomotor system with stable ductless glands. Proper environment, education, control of the nervous system and good immunity must be added factors.

The practical application of the laws of prevention concern us in a small measure at present as compared with the otolaryngologist of future decades. As infection is the all-important etiologic factor of acute and chronic pathologic change in the structures under consideration, the prevention of disease becomes a problem of great individual scientific interest in quarantine, sanitation, hygiene, immunity, heredity and sociology.

Can we prevent deafness, hypertrophic rhinitis, pathologic tonsils, adenoids or accessory sinus disease? How much are we interested in the study of

insect carriers? Do we realize that the house-fly can carry active tuberculosis germs from the sputum and deposit active tuberculosis germs on our food? Are we keenly alert to the possible dangers to our community of the suppurating ear of the ex-scarlet fever patient, or from the throat or ear of the diphtheria carrier? Do we take cultures from acute infections?

The prevention of disease of the accessory sinuses has become more difficult by the laws of evolution that made the postural change in man from a quadruped to a biped. Many unchangeable, etiologic factors of prenatal or postnatal structural origin make prevention difficult. Anthropology tells us that the modern Caucasián bears many marks of asymmetry or abnormal development that attend our higher civilization and departures from aboriginal conditions.

The medical inspection of schoolchildren has given the otolaryngologist a splendid field of statistical study and observation along the lines of prophylaxis. It would seem that the scientific fruit of this labor should be forthcoming in some future program.

What methods or theories have we evolved that will lessen the enormous number of pathologic tonsils and adenoids? We know that the nasopharynx and nasal passages, in infancy and childhood particularly, are the seat of constant histologic change. Under degenerative laws of disuse such as the olfactory sense, atypical structural integrity and lowered heredity and physical and moral standards, a direct tendency to pathologic change is encouraged. It is asserted by radicals, therefore, that as the adenoid is a menace and the gateway of infection, preventive measures demand in every case a thorough prophylactic operation in infancy. This ultraradicalism may be progressive and justifiable in the future, but watchful waiting in the absence of symptoms seems a more reasonable policy in the light of our present knowledge.

The faucial tonsil as an embryologic remnant deserves further research. Its function remains in

the realm of speculation and theory and the immediate and remote effects of its infection are thoroughly and generally realized, yet the wanton destruction of any structure will bring a reaction. We must, therefore, temper our procedure with judgment and skill, and operate under the rules that we would apply to our own flesh and blood.

When devotion to medical research and education in our particular realm shall unravel the mysteries of infection and the artificial and biochemical production of immunity, when the internal secretions may be regulated at the will of the therapist, the otolaryngologist will assume his greater rôle in the broad field of endeavor of preventive medicine and therapeutics. Major nose, throat and ear surgery will remain exclusively for the man of surgical mind, training and ability.

As the millenium has not arrived we must work on in our field of special choice under the optimistic banner, "We will do the best we can."

32 Adams Avenue.

CHRONIC FOCAL INFECTION OF THE NOSE, THROAT, MOUTH AND EAR

JOSEPH C. BECK, M.D.

CHICAGO

Chronic focal infection may be located anywhere in the body, but there are certain anatomic structures which are most frequently affected. These are the structures which possess recessions or pockets and which communicate with the external world. There are, however, some that do not have these characteristics and still may be the seat of focal infection with the whole train of symptoms of chronic toxemia and changes in consequence thereof. The most frequent sites of chronic focal infection may be divided into groups as follows:

1. Recessions or Terminal Pockets; meibomian glands; lacrimal glands; nasal accessory sinuses and mastoid cells; tonsils and adenoids; salivary glands and ducts; pulmonary alveoli and bronchi; gall-bladder and ducts; pancreas and ducts; appendix; uterus and fallopian tubes; prostate and seminal vesicles; pelvis of kidney, ureter, bladder and urethra; skin-glands, as sweat and sebaceous; mucous glands.

2. Tubular Structures or Ducts: gastro-intestinal tract; tear-duct.

3. Glandular or Parenchymal Tissue: lymphatic glands; compound lymph-glands, as Peyer's patches, lingual tonsil; liver, pancreas, spleen, muscles; ductless glands, as thyroid, adrenals, thymus and hypophysis.

4. Endovascular Tissue: endocardium and intimas of arteries and veins; lymph-vessels and lymph-spaces.

5. Serous Membranes: peritoneum; pleura; pericardium; synovia; perineurium; dura.

6. Pathologic Tissue: cavities in teeth; alveolar or apical necroses, and death of pulp, with or without alveolar fistulas; recession of gums, as pyorrhea; abscess or necrosis elsewhere in the body; infection about nails, and hair follicles.

While the subject can not be considered complete and comprehensive without considering all the groups, as mentioned above, it shall be my aim to devote myself to the chronic focal infections of the mouth, nose, throat and ear only, first, in so far as they may influence the other focal points of infection, secondly, the secondary toxemia and changes in the tissues and fluids of the body.

Before taking up the subject of infection one should study the question of body resistance and immunity, in other words the normal condition.

RESISTANCE

When is one in perfect health, and how may this condition be recognized?

In my opinion, perfect health is that state of the organism in which all the functions of the body are carried on without hindrance, and the body-weight is normal and remains so. Exposure to infection and other forms of disease (barring accident and senility) do not readily develop in such individuals. Health is further characterized by a normal mental state, there being no anger or worry manifested. With these qualifications one has the proper energy to work, in other words, the individual enjoys life. Besides this, the normal standards of anatomy and physiology will be of value in determining any deviation from the normal, and a thorough blood and physical examination will show the resistance of the body to disease.

The commonest factors in undermining the health are chronic diseases and chronic focal infection, particularly infection with pyogenic organisms. These reduce the vitality and resistance to acute or intercurrent diseases. Of course it is recognized that

immoderate or excessive use of stimulants, such as alcohol, and overeating and overwork contribute a great deal in lowering the vitality and resistance of the body.

Body resistance may be measured amperically by the standard of 100. Focal infection may also be amperically measured as to its ability to reduce body resistance. There is perhaps no one who may boast of a condition of body resistance of 100, and indeed this may not be necessary in order to possess perfect health. If, however, the resistance goes below, say, one-half, there will undoubtedly be manifested symptoms of disease.

IMMUNITY

According to Vaughan, immunity to any infection is due to the inability of the infecting agent to grow in the animal body. Immunity may be normal or acquired.

This immunity is not common, in fact it is absent, in the cases of most chronic focal infection, and only the best of attention to all the functions of the body, the use of bacterins or vaccines and other dietetic medical and hygienic measures may prevent acute outbreaks. It is plain, therefore, that chronic focal infections must be completely eradicated in order to obtain a cure, or to prevent the occurrence of acute or intercurrent disease. Some focal points of infection are spoken of by Billings as embolic and these, he says, cannot be reached very well by vaccines. In some locations where these embolic processes are located I believe that in addition to vaccines one may employ Bier's hyperemia; this would have a tendency to bring more blood to the parts, such blood being loaded with the introduced vaccines.

ORGANISMS

The various organisms that are most frequently concerned in the causation of chronic focal infection are mixtures of the following: The staphylococci and

streptococci of various forms, pneumococcus, *Bacillus coli communis* and *B. tuberculosis*.

Syphilis, sarcoma, carcinoma and other diseases manifest at times symptoms of chronic focal infection; in such case, secondary infections of bacterial type are present.

These organisms may with a few exceptions be located in any one of the above-mentioned locations and in several at the same time. There may be a variety of organisms in the different locations and a mixture in any one of them; for example, there may be a chronic focal infection of staphylococcus and streptococcus in the tonsils, a pneumococcus infection in the gall-bladder and a *B. coli* infection in the appendix.

The toxins, however, as was shown by Vaughan, are of the same deleterious action, no matter from what organism they emanate; he calls them the protein poisons. The study of the protein poisons, toxins and anaphylatoxin are essential in the management of chronic focal infection but can not be discussed in this paper. The recent experiments by Dick and Burmeister on the injection of triturated tonsillar tissue into animals are very interesting and may prove of marked practical value.

GENERAL DIAGNOSIS

As mentioned before, a patient with a chronic focal infection may manifest no other symptoms than a general inability to do good work, expressed as "not feeling well," such an individual is subject to frequent acute attacks of rhinitis, pharyngitis, laryngitis, tracheitis, bronchitis, and tonsillitis with all the possible local as well as general complications. The accessory sinuses, middle ear and mastoid, the lungs, gastrointestinal tract, lymph-glands and blood with the typical rheumatic affections are some of the commoner sequels well known to every one.

LOCAL DIAGNOSIS

The finding of the focal point by the presence of the pus, be it ever so minute in amount, is most important.

The Mouth.—The teeth should be examined by a competent dentist and death of the pulp, apical infections, carious cavities of teeth with alveolar necrosis and fistulas are among the commonest forms of disease, and pyorrhea alveolaris is looked on as a specific cause of focal infection. It is imperative to employ the Roentgen ray in diagnosis of some of the hidden conditions of the alveolar process. A markedly coated tongue and a diffused chronic stomatitis are not infrequently found with markedly diseased teeth in persons with no knowledge of oral hygiene. In these cases, one will frequently find a chronic infection of the salivary glands with markedly altered salivary secretion. Forcing some saliva out of Steno's duct will demonstrate many pus microbes.

The Nose.—Every one is familiar with the method of detection of pus from the sinuses by nasal examination, and suction, and roentgenograms are important additional diagnostic measures.

The Throat.—The nasopharynx in which the adenoids are located and which are subject to retentions of purulent secretions within their folds and pockets can be examined by the Hayes pharyngoscope, Gargai's direct method by the Brunnunges handle and spatula, Holmes' nasopharyngoscope, and postnasal mirrors, but I have been employing a direct method of exposing the postnasal space by means of a rubber catheter. Focal infections in the tonsils can very easily be diagnosed by pressure against the anterior pillar of the fauces, when either liquid pus or caseous masses will be expressed. Tenderness and redness are additional factors. The size of the tonsil has nothing particularly to do with the amount of infection that may be within it, and a small tonsil may be more injurious to the individual than a large one.

Of chronic focal infection of the larynx tuberculosis, secondary manifestations of syphilis and malignant growths may be mentioned, but these are not very *a propos* to the subject. There is, however, a form of chronic focal infection of the larynx, trachea and bronchi known as the chronic purulent tracheo-bronchitis of the aged, which can and does produce the well-known condition of chronic focal infection. Often such conditions of the larynx, trachea and bronchi are secondary to sinus infection, or foreign bodies of the bronchi.

The Ear.—There may be so little evidence of pus in a chronic suppuration of the ear as to be barely demonstrable, and yet the entire mastoid may be infected, causing chronic intoxication. The roentgenogram and suction will aid in the diagnosis.

The general physical examination with the aid of all the possible laboratory findings will conclude the diagnosis. One particular diagnostic feature I would like to mention is the opsonic index according to Wright; this has been very much neglected in the management of these conditions. Yet if one wishes to know the absolute resistance of the patient to a particular micro-organism that has been isolated from one of the focal points of infection, it will be found indispensable.

TREATMENT

Aside from the eradication of the focal point of infection one should employ aids that will increase body resistance.

Formula as to the degree of chronic focal infection:

From tonsils	20 per cent.
From gastro-intestinal tract.....	10 per cent.
From appendix.....	10 per cent.
From gall-bladder and several other recesses	10 per cent.
Total degree of infection.....	50 per cent.
Resistance	50 per cent.

Removal of the chronic tonsillar infection by complete tonsillectomy will leave only about 30 per cent.

of chronic focal infection which, with the addition of autogenous vaccination and other medicinal hygienic and dietetic measures, will be rapidly eliminated by the increase of antibodies, and so establish nearly normal health and resistance.

I now come to the question: Why are the tonsils and adenoids most frequently mentioned as the source of chronic focal infection and why should they in preference to any other chronic focal infected point be attacked, unless that other focal point is more manifestly possible the cause of the general condition? It has been definitely proved by Weichselbaum, Groeber, Wood and many others that the tonsils and adenoid tissue in the Waldeyer ring has the greatest power of retaining infectious material and that the lymphatic distribution to and from these structures is very great. It has been further noted by every laryngologist, as well as by many general practitioners who have had considerable experience with removal of tonsils and adenoids, that marked gain in weight and general well-being, with disappearance of the local as well as the general condition in the majority of instances, follows such a procedure. In many instances of focal infections other than the tonsils and adenoids, as for example, chronic suppurative otitis media or chronic purulent sinusitis, the latter condition cleared up or markedly improved following removal of the tonsils and adenoids. Of course it must be borne in mind that if such pathologic conditions as necrosis of the bones and cholesteatoma are present that the removal of tonsils and adenoids will not effect a cure.

Not alone will a suppurative ear or nose condition often be cured by the removal of tonsils and adenoids, because that may be due to the removal of pathologic structures which would have extended by continuity, but a suppuration quite distant from the tonsils as, for instance in the bladder or uterus, will be markedly improved or cured. The essential point I wish to

make in this paper is that by removing a definite focal point of chronic infection (tonsils) the resistance and healing power of the patient is given opportunity to recuperate, and the individual thus is enabled to destroy other focal points of chronic infection, and putting the system in a condition to ward off acute attacks. I called attention to this fact before this Section four years ago¹ in the following words:

I should like to present a theory as to the raising of the opsonic index of the blood to all infections when the tonsils are enucleated. If, for instance, there exists some pathologic condition of the body, near to or distant from the tonsils, which refuses to yield to the treatment applied to the said condition, if there exists merely a lack of healing power, due, most probably, to the constant absorption of toxic matter from the diseased tonsils, and if this toxic absorption is done away with by the complete enucleation of the tonsils and the pathologic condition heals, is it not reasonable to assume that the drain on the system has thus been stopped and the blood given a chance to become powerful enough to cure the disease in question because of the enucleation of the tonsil? For example, operation is performed several times for osteoperiostitis of the zygoma, but the tissues refuse to heal in spite of all treatment, medical as well as surgical. The tonsils, which are diseased, are enucleated and the disease of the zygoma promptly heals, while every other evidence of marked improvement in the general health is presented. Again, we all recognize the increase in weight and improvement in the general health, especially in children, after the removal of the tonsils and adenoids.

This theory, moreover, applies not only to the tonsil but to other structures as well; for instance, a man has tuberculosis of the kidney, with an external fistula and a hip-joint tuberculosis; if the latter is arrested the patient gains in weight and strength and the fistula and tuberculous kidney promptly heal.

Such results as these are more than mere coincidences and, to my mind, can best be explained by the above-mentioned theory.

That is one reason why the chronic infected tonsils and adenoids should be removed. The second reason why they should be removed in preference to any other structure is because with properly carried

1. Beck, Joseph C.: Conditions Demanding Enucleation of the Faucial Tonsils, *THE JOURNAL A. M. A.*, Oct. 29, 1910, p. 1523.

out technic there is less danger and inconvenience to the patient, without losing or interfering with some functioning structure. In addition to removing the structures containing the focal point of infection, or evacuating the infected material, we also obtain the predominating organism or organisms in culture and make therefrom an autogenous vaccine or bacterin. Just as soon as the patient has completely recovered from the operation we employ this vaccine in the full dose and continue to do so for an indefinite but prolonged period. This is done to insure complete neutralization of the toxins or elimination of all the trouble.

CONCLUSION

In conclusion I wish to say that all those who believe that chronic focal infection is a hobby would do well to adopt it, rather than remain on the outside making unjust and severe criticism without really giving the subject a fair trial. I well remember a discussion at the Chicago session, in which I strongly advocated the complete enucleation of the tonsil on account of the possible cardiac complication from rheumatism, and one of the speakers stated that he saw no reason why all the tonsil must be removed because, as he put it, it was not cancerous. This same member is now one of the warmest advocates of the complete removal of the tonsil, and an enthusiast on the subject of chronic focal infection.

From my experience I am sure that I have done very little if any harm by the removal of tonsils and adenoids for this purpose and I am sure that I have done considerable good.

108 North State Street.

THE FAUCIAL TONSILS AS A GATEWAY TO GENERAL INFECTIONS

NORTON L. WILSON, M.D.

ELIZABETH, N. J.

Attention is directed to this important subject, not because physicians are not familiar with it, but because they do not emphasize sufficiently the seriousness of tonsillar infections. It may seem like presumption on my part to present to this Section a paper on this subject on which so much has been written. If, however, we can prevent some child from going through a short life with a damaged heart or kidney or can curtail the many swollen joints and the intense pain which accompanies them, we have in a measure fulfilled our mission on earth.

There are many good general practitioners and, I may add, a few laryngologists, who have not yet realized that cases of so-called acute articular rheumatism, acute nephritis, acute endocarditis, pneumonia, appendicitis, orchitis and many other acute infections may be the result of acute cryptogenic infection of the tonsils. I do not wish, however, to convey the idea that the tonsils are the only source of infections. I have seen acute articular rheumatism and acute nephritis follow acute otitis media, and it is an established fact that typhoid fever enters through the lymphatics of the intestines, and severe toxemia may follow acute inflammation of the lymphatics of the pharynx and epipharynx.

In my opinion, however, the faucial tonsils are the most frequent sources of infection. There is abundant evidence in the literature to show that many general infections take place through the tonsils, pharynx and nasopharynx with its adenoid tissue, the peritonsillar

tissue, the lymph-nodes and lymphatic tissue of the retropharynx, the lingual tonsils, the middle ear, the teeth, gums and urethra. The ring of Waldeyer is the most vulnerable part of the body and the faucial tonsils the most frequent seat of inflammatory attacks. In 1885 I read a paper before our county medical society calling attention to the close relationship between tonsillitis and rheumatism, but just what that relationship was was not definitely established at that time. It is now known that the streptococcus or other germs can enter the blood through the medium of the tonsils and attack the joints or heart or kidneys. The specialist is not active enough in spreading this belief, and when I say specialist I include the pediatrician, because he probably sees more of these cases than the laryngologist.

In 1910 Loeb¹ cited four cases, and said: "Acute nephritis results from acute tonsillitis far oftener than is generally believed."

In 1912 our former chairman, Dr. George E. Shambaugh,² said: "As regards the appearance of the faucial tonsil which is a focus for systemic infection, it is quite clear that the size of the tonsil is no index of the menace this structure may be to the individual."

With this statement I think we are all in accord.

In 1907, Dr. Philip K. Brown³ gave a very wide range of diseases which may gain entrance into the body through the tonsils; he mentioned pericarditis, myocarditis, endocarditis, arthritis, chorea, neuritis, pleurisy, tuberculosis, iritis, phlebitis, osteomyelitis, Hodgkin's disease and possibly certain forms of leukemia.

Dick and Burmeister,⁴ speak of the toxicity of the human tonsils. They are of the opinion that such con-

1. Loeb, W. H.: Acute Nephritis Following Acute Tonsillitis, read before the American Laryngological, Rhinological and Otological Society, 1910.

2. Shambaugh, G. E.: Paper read before the American Laryngological Association, 1912.

3. Brown, P. K.: Remote Effects of Tonsillar Infection, *THE JOURNAL*

A. M. A., June 15, 1907, p. 2024.

4. Dick and Burmeister: *Jour. Inf. Dis.*, September, 1913.

ditions as asthma, convulsions and even true epilepsy may be produced through the agency of the tonsils.

W. P. S. Branson,⁵ gives us the result of an examination of a patient with Sydenham's chorea. His belief is that Sydenham's chorea and rheumatic fever are due to one and the same infecting agent, and he has shown that the commonest avenue of rheumatic infection is the tonsil and next to it the nose.

D. J. Davis,⁶ reported the result of his observations of forty-two cases of chronic streptococcus arthritis; in all of these cases the source of infection was in diseased tonsils.

F. Theisen,⁷ reports six cases of acute thyroiditis following tonsillitis.

Dr. Ben Witt Key,⁸ speaks of absorption from tonsillar infection as a causative agent in phlyctenular conjunctivitis.

There have come under my care eight cases of infection which in my opinion had their origin in the tonsils.

CASE 1.—Nephritis. A young man, aged 18, had acute lacunar tonsillitis, ten years ago. Urine was normal. Three weeks after I first saw him it was noticed that his face and hands were edematous. Examination of the urine showed he had acute nephritis. The nephritis followed so closely on the tonsillitis it made me wonder if I had not been mistaken about the tonsillitis and had really had scarlet fever to deal with. There was no desquamation and no other cases of scarlatina in the house and I was forced to conclude that the nephritis was due to tonsillitis. He made a good recovery in five weeks.

CASE 2.—Rheumatism. A woman, aged about 30, consulted me for a sore throat. The follicles of the pharynx were found to be enlarged and red with the crypts of a moderate sized tonsil inflamed and filled with cheesy débris. She complained not only of sore throat, but of pains in the chest. A careful examination by most competent physicians showed the chest pains to be muscular. They were in my opinion due to infection from the tonsils. The removal of the tonsils was advised but the patient would not consent to operation.

5. Branson, W. P. S.: Brit. Med. Jour., Nov. 23, 1912.

6. Davis, D. J.: Chronic Streptococcus Arthritis, THE JOURNAL A. M. A., Sept. 6, 1913, p. 724.

7. Theisen, F.: Albany Med. Ann., 1913, xxxiv.

8. Key, B. W.: Ophth. Rec., June, 1914, p. 273.

The crypts were cleaned out and painted. She consulted me several times each year for the same trouble. The method adopted gave her temporary relief as did sodium salicylate or aspirin. In 1908 she submitted to enucleation of the tonsils. From that time until the present she has not suffered from sore throat nor have her chest pains returned.

CASE 3.—Nephritis. In June, 1910, I was called by Dr. Grier to see a case of quinsy in a young man aged 22. The abscess was opened. The urine was examined and found to be normal. One week following, his eyelids were puffy and examination of the urine showed acute nephritis with albumin, casts and blood-cells. He made a good recovery in a month.

CASE 4.—Nephritis. In 1912 a young woman of 18 was treated by her family physician for acute tonsillitis. She had had several attacks of tonsillitis and wanted the tonsils removed. About ten days after the attack of tonsillitis, I arranged to remove the tonsils. When I arrived at the hospital I was told the urine was normal. She was etherized and one tonsil enucleated, when the house physician rushed into the operating-room and informed me there had been a mistake, the urine from this patient showed considerable albumin, casts and some blood-cells. The other tonsil was removed, she was put to bed in the hospital and kept on milk diet for two weeks; in five weeks all evidence of nephritis had disappeared, notwithstanding the fact that she had been thoroughly etherized.

CASE 5.—Rheumatism. A physician, aged 51, was attacked with a lacunar tonsillitis. Temperature did not go beyond 101; in fact, he kept about the office much of the time. In five days his right big toe-joint became red, swollen and painful and two physicians who saw him pronounced it gout. The urine was negative throughout the entire attack. After a week the toe-joint became normal. Three days after the joint became well, the left ankle became swollen, red and painful. The throat remained somewhat sore throughout the attack. The joint affection was then diagnosed by four physicians as a streptococcus infection from the tonsils. The tonsillar crypts were curetted and painted with a solution of iodin and phenol (carbolic acid). The ankle-joint became normal in a week's time. One week later the tonsils were enucleated, and a long chain streptococcus recovered from the crypts of the tonsils, notwithstanding the curetting and painting with iodin and phenol solution. In order to control hemorrhage he was given 40 grains of calcium lactate on Wednesday, 45 grains on Thursday and 20 grains on Friday morning, making a total of 105 grains. The tonsils were enucleated under local anesthesia Friday afternoon, and there was very little hemorrhage. His blood-clotting time before taking the calcium was seven minutes; Friday morning after he had taken 105 grains it was two minutes.

Just a word regarding the administration of calcium salts. We have proved conclusively by the aid of the Biffi-Brooks coagulometer that the normal blood-clotting time with this instrument is seven minutes in the adult. We have reduced the blood-clotting time to one minute after the administration of 120 grains of calcium lactate. It must be given in from 10 to 15-grain doses three times a day for three days before operation to decrease the blood-clotting time.

If a general anesthetic is given there may be just as much bleeding at the time of the operation as there would be without administration of the calcium, but the bleeding is much easier to control, and once controlled is not apt to recur. Slight pressure will plug up the end of the vessel and in this way the hemorrhage may be controlled.

Case 5 has almost its counterpart in that of another physician, but he still has his tonsils and it will be interesting to see which of the two doctors will enjoy the better health.

CASE 6.—Keratitis. Mr. B., student, Jan. 23, 1914, had a sharp attack of tonsillitis. The crypts contained the usual inflammatory exudate, but unfortunately no bacteriologic examination was made. One week later his right eye became sore and it was found he had a severe attack of central interstitial keratitis. He denied lues and a Wassermann examination was negative. I desire to call attention to this case as I have seen no similar report.

CASE 7.—Rheumatism. K. M., aged 18. Twelve years ago I removed this patient's tonsils after the manner of the operation at that time, which was not enucleation. He never had another attack of tonsillitis until this winter, when he had a severe one, which was soon followed by an affection in his right knee and right thumb. He never had rheumatism before. I enucleated the tonsillar stumps last April.

CASE 8.—Rheumatism. H. C. C., male, aged 18, has had several attacks of tonsillitis but never had rheumatism until last August, when one week after an attack of tonsillitis his ankle-joints became swollen and painful. He was taken to Mount Clemens for treatment. Last October a pair of buried tonsils were enucleated, since which time he has had neither tonsillitis nor rheumatism.

My associate, Dr. Keefe, reports to me four interesting cases of a similar nature, one of which was in a child 6 years old, who had double mastoiditis and pleurisy following an attack of tonsillitis.

Through the courtesy of my associate, Dr. Schlicherter, I am able to report the following case:

Miss K. K., aged 25, a domestic, had an attack of lacunar tonsillitis, followed in one week by acute nephritis. She was sent to the hospital, March 7, at which time she had no heart lesion. The kidney lesion had almost subsided when, March 19, about eighteen days after she was first attacked with tonsillitis, she was stricken with acute septic endocarditis and died the next day.

We have abundant clinical evidence of infection from the tonsils, and it may be profitable to spend a few minutes reviewing the laboratory evidence.

Dr. MacLachlan of the University of Pittsburgh, in a histopathologic study of 350 pairs of tonsils, makes the following statement:

We have observed that when symptoms of acute tonsillitis are present there is always a pathologic basis as shown by ulceration of the lining of the crypt. We therefore feel that a similar lesion is present in the tonsillitis preceding rheumatism and as far as we know, this lesion differs in no way from that of acute lacunar tonsillitis. We regard the ulceration of the lining of the crypts as being the vulnerable point of entry of organisms from the mouth. It matters little apparently what bacteria have produced the lesion, for once the ulcer has formed, it is possible for any type of organism to gain access to the deeper tissues.

Such is the probable origin of acute rheumatic fever following tonsillitis. The tonsillitis is not rheumatic but pyogenic in origin and the development of rheumatism is in all probability due to an overwhelming invasion of the rheumatic infection the nature of which is not definitely known.

At the meeting of the Eastern section of the Triological Society held in New York during January, 1914, Dr. George B. Wood of Philadelphia, demonstrated on the screen the presence of bacteria in the tonsil of the hog which had penetrated the cryptal epithelium into the interfollicular tissue.

The late Dr. LeFevre in discussing the paper was thoroughly in accord with the view that rheumatism is an infection which gains entrance into the body through the tonsil.

Dr. Wood in his article on tonsillar infection in the hog says:

The anthrax bacillus penetrates through the cryptal and not the surface epithelium. It probably always gains access to the parenchyma of the tonsil by passing through the living unaltered cryptal epithelium, and having gained access to the superficial layers of this epithelium, it tends to multiply in the deeper layers and thus pass into the interfollicular tissue.

The rapidity of the invasion is influenced both by the virulence of the organisms and by the susceptibility of the individual animal. In some of the sections examined the bacilli were found penetrating the blood-vessel walls and a few were seen in the blood-current.

From the laboratory and clinical studies we are forced to conclude that infection does take place through the tonsils.

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ABSTRACT OF DISCUSSION ON PAPERS OF DRs. BECK AND WILSON

DR. GEORGE E. SHAMBAUGH, Chicago: One of the most important contributions to medicine during the past decade has been the elucidation of this relation between focal infection and serious systemic diseases. The most important focus in the causation of chronic systemic infection, appears to be the faucial tonsils, which cause, as Dr. Beck has stated, more trouble than all the other foci together. The reason is not difficult to find. The faucial tonsils are more frequently the seat of severe, acute infection than is any other organ in the body. It is rare to find an adult who has not experienced one or more attacks of acute follicular tonsillitis. The tonsils with their deep pockets are admirably suited to retain latent foci of infection capable of causing the most serious systemic trouble. The etiologic relation between an attack of acute tonsillitis and one of rheumatism, nephritis or neutritis which immediately follows the acute infection, is easily recognized. Not all the cases in which this relation of cause and effect exist are so readily recognized. A patient recovers from the acute tonsillitis with latent unsuspected foci remaining in the tonsils, and only after the lapse of some months or even years, does the evidence of systemic infection appear.

It is in the recognition of these chronic cases that the chief difficulty presents itself. In such cases an examination of the tonsils will often disclose such positive evidence of foci of infection as pockets of pus. In other cases no pus can be expressed from the tonsils but their congested edematous appearance indicate distinctly that they are the seat of inflammatory reaction. At other times the history of recurring attacks of tonsillitis in previous years leads one to suspect the tonsils as the possible focus for the systemic infection. Not infrequently no distinct evidence of infection in the faucial tonsils can be demonstrated, nor will the patient recall ever having had an attack of tonsillitis, and yet when the tonsils are removed abscesses of varying size will be disclosed in them. It is evident to all that in the proper handling of these cases of systemic focal infection it is of great importance that our work should cooperate with that of the internist, the dentist, etc. The specialist working in isolation is likely to overlook the tonsil as the possible cause of the trouble because he fails to detect palpable evidence of infection in it, or he may remove tonsils when other foci, which the internist would readily detect, are really causing the systemic trouble.

DR. ROBERT LEVY, Denver: Year after year the importance of the tonsils in relation to general infections is repeated in this Section. We ought to emphasize the importance of these facts to our friends in other branches of medicine. It is true some of our internists and pediatricians are awakening to the importance of this subject, but it is often astonishing how many there are who do not as yet realize it. The previous history of every case in which the patient is suffering from recurring attacks of tonsillitis is worthy of much consideration. Dr. Shambaugh states that previous attacks of tonsillitis pass out of the memory of the patients. Perhaps we must go back to the first attack in early childhood. In many cases the most careful investigation fails to reveal any previous attack of this affection, but on careful investigation we find that during childhood attacks of sore throat occurred which had been forgotten. In childhood we often find a history of attacks of indisposition with more or less fever and nondescript symptoms which were attributed to disordered stomach. No local affection of the throat was recognized. Very frequently one can determine that these attacks were really due to tonsillar infection and in our subsequent management of the case should be so considered.

DR. GEORGE L. RICHARDS, Fall River, Mass.: I agree with what Drs. Beck and Wilson have said concerning the danger of focal infection, but one point they have not referred to. Nearly every city now has school inspectors who examine the throats of children and, as a result of these examinations,

we have a great many children brought to us, especially in the clinics, with the statement that "this child has enlarged tonsils," or "he has adenoids." All the history they bring is that the inspector has said that they have enlarged tonsils or adenoids. The child complains of nothing, but the inspector says he has enlarged tonsils. Now, shall we take out all these tonsils or shall we wait for definite symptoms? We are still about as much in the dark with regard to the physiology of the tonsil as we ever were. If we say that these patients don't need to be operated on, we find later that some other doctor has done the operation. I call attention to the fact, based on a chance to observe a great many children whose tonsils have not been taken out but from whom the adenoids have been removed, that these children are frequently brought back for a tonsil operation. Often after tonsils are removed there is a reproduction of granulation or follicular tissue along the posterior pillar and sometimes between the pillars, as though nature endeavored to protect herself in some way with this new tissue.

DR. OTTO T. FREER, Chicago: The list of diseases serving as an excuse for tonsillectomy has been growing at an astonishing rate and such ailments as muscular rheumatism, neuritis, palpitation, goiter, chronic Bright's disease, laryngitis, nervous cough and vasomotor rhinitis have been included as unquestioned proof of some supposed but not evident focus in the tonsils. In fact the path of sound pathologic research has been left for vague speculation, based, as such speculation usually is, on some truth. The view that chronic tonsillar focal infection is frequent is not in accord with common clinical experience which, while it long ago recognized the tonsils as a source of such acute systemic infections as articular rheumatism, nephritis, endocarditis, pyemia, etc., is supposed in the long ages to have overlooked what the investigators have claimed to be so obvious, chronic focal infection. This overlooking, concerning what is asserted to be a sequence of great frequency, seems incredible considering how carefully etiology has always been studied, and the sequence, that many grave and obstinate diseases depend on a mysterious tonsillar focus which does not even locally indicate its presence, is not in harmony with the daily experience of laryngologists to whom most of the diseased tonsils with obvious foci come, not as causes of systemic disease, but on account of the local inflammations caused by them, for the patients bearing these tonsils are not rheumatic nor do they seem to be afflicted with more chronic ailments than other people. On the focal-infection theory we should, at least, have many rheumatic cripples coming to us, while the fact is that in the intervals between attacks of tonsillitis or peritonsillitis our tonsil patients are quite well. Many apparently normal tonsils, in patients with chronic ailments,

are removed as sources of infection without improvement of the patient's condition and should have been left untouched.

DR. W. W. CARTER, New York: I treated a little girl four years ago who had an acute tonsillitis and on examination I found that she had chronic endocarditis. Two days later she had an acute attack of endocarditis and I ascertained on getting a fuller history of the case, that she had had three or four attacks of tonsillitis. When she had recovered from this attack I tried to get permission to remove her tonsils but the parents objected on the ground that she had heart trouble. I saw that child in three subsequent attacks of tonsillitis and in from twenty-four to forty-eight hours after the beginning of each attack she had an acute endocarditis. About two years after I first saw her she died. As has been said, the size of the tonsil has nothing to do with the question. The dangerous tonsil is the submerged one and the one that has had several previous infections. Pathologic changes have occurred in the crypts, drainage is interfered with, and then we get absorption. We must conclude from our clinical experience that the tonsil is the real source of most of our focal infections and that, therefore, we must remove the tonsil. At present that is the only solution of the problem, unless there is some other obvious source of the infection. I wish to emphasize the fact that we seldom have focal infection following the first attack of tonsillitis. It is only after several attacks when these pathologic changes have occurred in the crypts that we get the general infections.

DR. JOHN F. BARNHILL, Indianapolis: The whole question is one of diagnosis, and physicians who practice laryngology ought to be as careful here in the matter of accurate diagnosis as in other branches of medicine. That it is wrong to remove the tonsils in every case is not questioned. Dr. Beck's paper brought out much that ought to be included in every history sheet. It is wrong, in a large majority of cases, to remove tonsils until one has gone into all the points concerning focal infection. Our history sheets should ask questions concerning rheumatism, nephritis, arthritis, heart-disease, etc.; and may show that the general infection has been entirely due to some other cause than the tonsils. There can be no question, however, concerning the correctness of Dr. Wilson's contentions. There are such cases as he speaks of and we should be more active in removing such tonsils. We should be better teachers in what concerns the public welfare. It has been alleged here that the general practitioner has been slow in appreciating these things. My own experience is that they have often been quicker than we have. The first cases I ever saw and had clearly brought to my attention, of focal infection due to the tonsils, were brought to my notice by a general practitioner. A certain professor had been so ill with heart-disease for a long time that he could not carry on

his work. He came into the hands of Dr. Osler who went over him again and again and finally said, "Your tonsils are the cause of all your trouble." He advised that the patient be operated on thoroughly but the tonsils were only clipped. The illness continued over a period of two years. Osler had gone abroad and the patient came into the hands of Dr. Janeway, who after careful examination told him the same thing. Then the patient's tonsils were completely enucleated and ever since, or until his death from pneumonia some time ago, this patient remained well. Another instance was that of a child, very ill with endocarditis, following an acute tonsillitis. The family physician requested me to examine the tonsils. I did not see much there but on the insistence of the physician, the tonsils were removed, and to my surprise, in one of them a deep abscess existed containing a teaspoonful of fluid pus, which evidently had been there since the acute attack of tonsillitis two years previously.

DR. DENNIS J. McDONALD, New York: The important thing is, as Dr. Barnhill said, the question of diagnosis. We should know what tonsils to remove. As to the question of school inspectors, considered from an economic point of view, it is well worth the tax payer's money to have these matters taken up in a proper systematic way, and the important thing is to have proper inspection and to know what cases are to be operated on. This Section ought to draw up a memorial advising that all cities of 50,000 or over should have one or more specialists make a proper survey of the situation. In larger cities the committee should consist of four physicians; two nose and throat specialists, one pediatrician and one orthopedist. In this way we could arrive at some proper working knowledge.

DR. THOMAS E. CARMODY, Denver: Dr. Wilson gives credit to calcium lactate when, possibly, it should not be credited. I have taken the coagulation time in a number of cases and for some reason or other was unable to operate at the time planned, and a few days later found coagulation time to be from one to two minutes longer or shorter. The normal time of coagulation with the Boggs instrument, which I use, is four minutes, but there may be variations in the same person. With regard to focal infection it begins in the tonsils often because the tonsillar crypts cannot empty themselves on account of lack of muscular fiber in the tonsils, or hypertrophy of muscular tissue in the pillars covering the tonsils. We have examined about one hundred tonsils and found various conditions. We find in a number a lack of epithelium and infection can so gain access. The probabilities are that we never get infection through the intact epithelium. Another reason why the crypts become filled with secretion is because of loss of this epithelium. The secretions cling to the surface

devoid of epithelium in the crypts, like scabs on the surface of the body, or on the walls of the nasal cavity. It was stated that these children do not complain of throat symptoms. I have seen a number of cases in which, on examination, the patients were found to have tonsillitis although nothing could be learned on questioning the child.

DR. STANTON A. FRIEDBERG, Chicago: I have been associated with Dr. Shambaugh in a good deal of the same kind of work he mentioned and can endorse what he said with regard to focal infections. One criticism has been offered concerning the results of treatment. In the chronic arthritic cases I think it is sufficient if we are able to limit the process of the infection. We cannot expect a loosening up of the joints to a normal state. In these patients, some of them 60 years or more of age, if we can limit the progress of the disease we have accomplished a great deal. One point that has not been brought out is the possibility that the ear may be the seat of focal infection. Dr. Borden, a year ago, presented this theory. At a meeting of the Laryngological, Otological and Rhinological Society he cited a number of cases of nephritis in conjunction with otitis media, in which after the mastoid operation had been performed, there was a rapid clearing up of the nephritic condition. I have had the same experience.

DR. EMIL MAYER, New York: One condition that we frequently encounter in our patients and that has not been mentioned here, perhaps because we have been speaking of more serious complications, endocarditis, nephritis and things of that sort, is that patients will come with a complaint, that for want of a better name they call a rheumatic condition of the throat—a feeling of fulness and soreness. In these cases I have been able to express, by means of compressed air, some decayed material from the crypts which has caused this trouble. It is not a bad suggestion to treat some of these cases in that way. While I have not seen Dr. Wilson's bibliography, I called attention to these focal infections a considerable while ago. We have all spoken of the good results from our tonsillectomies, but what about the bad results, about the cicatrical conditions after bad operations? If we want to teach the general practitioner to appreciate our work, we must be sure that our work is good. If not, you will see what I have seen, cicatrical tissue in the postpharyngeal wall, an appearance as though there has been a syphilitic process.

DR. W. E. DIXON, Oklahoma City: History tells us that Celsus in the year 10 A.D. advocated the removal of tonsils. Celsus didn't say why, but he used the same method that Dr. Richards employs, removing them with the finger, and he did not stop there, but adopted Ballinger's method, with the

scalpel. As to the matter of making a diagnosis of tonsillar infection, do we know that the removal of diseased tonsils is going to stop the rheumatism when we know that there are other sources of infection, as the accessory nasal sinuses? If these are not looked after, we may still have a continuance of the infection after removal of the tonsils.

DR. A. I. WEIL, New Orleans: The matter of further education of the profession and of the laity is one which is well worth considering. Patients have come to us not through their own physicians, but independently, and the poorer classes come in the clinics. Even the negroes will say "This child has tonsils and adenoids," and if you refuse to operate they are disappointed and go elsewhere. They have learned that these things are the cause of innumerable troubles. Many of these tonsils are normal and require no interference, but it is difficult to tell always which tonsil is causing infection. That is well illustrated by a case in my own family; a child of 4 or 5 years who had been subject to such indispositions, as have been referred to by Dr. Levy—periodic attacks of fever and mild illness, the tonsils apparently perfectly normal; no previous attacks of tonsillitis; some enlarged glands in the neck. I got the reluctant consent of the parents to remove the tonsils and after they were removed these periodic attacks of mild illness disappeared. The child has taken on weight and is apparently much improved, although the tonsils were apparently normal. I had my attention called to the toxicity of these infections some years ago when doing work on tuberculosis of the tonsils. In the course of my work it was my practice to inject titrates of tonsils into guinea-pigs and it was surprising how promptly they died from general infection. These tonsils were loaded with organisms of all kinds.

DR. E. B. GLEASON, Philadelphia: In connection with Dr. Wilson's paper, it would be interesting to inquire what are the more common sources of infection of the tonsils themselves? When we remember how frequently alveolar abscesses occur, our attention is directed to them as a source of tonsil infection. A case in point will show how important this matter is; a gentleman between 50 and 60 years of age, with perfectly normal tonsils, for some years had recurrent tenderness of the right first and second molars of his lower jaw. The last attack commenced with tenderness in these teeth, then the tonsil on the same side became infected; he had a temperature of 102 or 103 F.; the other tonsil became infected and later a purulent rhinitis started up. Culture of the secretions from the nose showed a nearly pure culture of *Streptococcus brevis*. The extraction of the teeth brought about an abrupt cessation of the attack. The roots of both teeth below the gums were carious and the alveolar abscess

swarmed with streptococci. Before attacking the tonsils it would be a good plan, in the majority of cases, carefully to examine the nose, accessory sinuses, and more especially the condition of the jaws, because latent foci of pus in the jaw is much more common than in the tonsils. If patients with acute articular rheumatism in our hospitals are questioned, some curious phenomena will be noted. Very few of them have had previous attacks of tonsillitis. I remember a number of patients that I questioned in this way in the Medico-Chirurgical Hospital and some of them had had recurrent attacks of tonsillitis when they were young, none of which were followed by rheumatism. After these attacks of recurrent peritonsillar abscess ceased to occur and the tonsils became normal, the attacks of acute articular rheumatism occurred, and were evidently from some other source than the tonsils. The tonsils are usually swollen during the time the 6 and 12-year molars are erupting and sometimes during the "cutting" of other teeth.

DR. HUDSON MAKUEN, Philadelphia: No one will deny the theory of focal infection, and few of us will question that the tonsil is one of the sources of systematic infection, but is there not a possible danger in the frequent reiteration of this fact? The tonsil operation, in my opinion, is already too popular. I should not be surprised if some of us have done the operation for the simple reason given by Dr. Richards, namely, that "if we didn't do it some other fellow would." Another thing that makes the operation too popular is the teaching that the removal of the tonsil does no harm. Now the removal of the tonsil may and sometimes does do harm. In a recent paper on the subject, I made the statement that an extracapsular tonsillectomized pharynx is always a damaged pharynx, and I believe this to be a demonstrable fact. I think we ought to insist on a fuller investigation of the conditions before we operate. We should try to be sure in every case whether or not the tonsil happens to be the cause of the infection, and if it is, let us remove it and if it is necessary to do an extracapsular operation, by all means let us do that, but let us remember that it is possible, in many cases, to remove the source of infection without doing this radical operation.

DR. HAROLD HAYS, New York: It seems to be really a question as to whether or not the tonsil is responsible for every acute infection that the body is heir to. The same thing has been said of the appendix. In the New York Eye and Ear Infirmary in the last five years something like five thousand tonsillectomies have been done. They are removed to prevent infection. Many of these children that are suffering from malnutrition are found to have some focal infection as the cause. I think a great many of these cases in children

that do not develop properly are due, not to infection from the tonsils, but to obstruction or chronic irritation of the throat. In many patients we find no evidence of tonsillar trouble. In a few weeks the patient has acute rheumatism. He doesn't return to us and we cannot say whether or not the tonsil is infected, but, in the majority of cases of acute articular rheumatism, I believe we would find that very few of the patients have had acute tonsillitis. Of course there is no doubt that patients with nephritis or rheumatism may have enlarged tonsils. It is important to consider that there are possibly some other sources by which infection may get into the system. A great deal of this work has been done as a result of having cases sent to us for more or less promiscuous reasons. The majority of us are looking for trouble in the throat. A great many tonsils are removed perhaps without doing any harm but also without doing any good.

DR. C. E. COOPER, Denver: In connection with the question of diagnosis and operation, I have found it helpful to ascertain whether or not the tonsil is infected. If a needle is plunged into the deep tonsillar structure and a sufficient number of small punctures are made, enough fluid and blood for examination will exude. A culture made from this will give the bacterial flora of the substance of the tonsil. If it is a streptococcal infection, it is an indication for operation. I have seen several cases of acute and chronic nephritis associated with infected tonsils and consider it an indication rather than a contra-indication for operation.

DR. RUFUS B. SCARLETT, Trenton, N. J.: The trend of the discussion seems to be toward the tonsils as a source of general infection. No doubt at present dentistry is being better done than it was ten or fifteen years ago when decayed teeth, as a rule, were not filled to the roots as they are to-day. Some of these teeth filled in this incomplete way are now causing trouble through the pulps infected at the time of the decay. I speak of this because during the past year I sought information as to the cause of an infection and consulted the best men I could find. Only recently a roentgenogram located an abscess at the root of a tooth. Very often a systemic infection may be attributed to the tonsils by a process of elimination when it may really be due to a pocket of pus at the root of a tooth.

DR. BURT R. SHURLY, Detroit: One point we have as yet, not mentioned. Those of us who have practiced internal medicine know how frequently in cardiac disease two or more murmurs may be heard in the heart, and often, as we narrow down and become more and more concentrated in one line, we fail to look further after finding one explanation for a trouble, one particular focus of infection. If we find it in the tonsil we are satisfied and look no further. It would be

unfortunate not to emphasize this fact. Internists are not satisfied with diagnosing one cardiac murmur when there may be more, and we should constantly bear in mind that there are frequently two or more locations for our focal infections. If we happen to be the first to investigate the case, we must consider this possibility, and if necessary have the internist aid us in our search.

DR. JOHN J. SULLIVAN, Scranton, Pa.: We are having a dress reform, a religious reform, and a half dozen other reforms all over the country and I suppose now we must have a tonsil reform. It is simply a matter of more accurate diagnosis whether or not the tonsils shall be removed.

DR. JOSEPH C. BECK, Chicago: Concerning Dr. Freer's remarks with regard to exophthalmic goiter as caused by infection from the tonsils, he can find plenty of evidence that this is so; not directly from the tonsils to the thyroid, but due to changes in the glands of internal secretion brought about by toxicity. The tonsil is a frequent cause of that toxicity and hence, is the most important structure for us to study in that connection, not that there are not other foci too. By removing a certain percentage of chronic focal infections, we enable nature to take care of and eradicate the other foci.

DR. NORTON L. WILSON, Elizabeth, N. J.: Every time I have tonsils to remove I ask for what reason they are to be removed. I, too, have had cases sent in by the school inspectors but would not remove the tonsils without some specific reason. I took it for granted that every throat surgeon was possessed of a certain amount of common sense and such a man doesn't remove every tonsil he sees any more than an abdominal surgeon would remove every appendix that comes his way. With regard to the remark that the coagulation time is four minutes, I stated that the normal coagulation time with the particular instrument I used was seven minutes. Of course, each variety of instrument has its own clotting time.

LATENT AND TERTIARY SYPHILIS IN DISEASES OF THE NOSE AND THROAT

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The importance of the diagnosis of syphilis in any part of the body cannot be overestimated. In the primary and secondary stages, syphilis is a serious matter; in the tertiary stage of nerve lesions it is a calamity. Recent statistics state that 20 per cent. of treated patients and 40 per cent. of all afflicted with the disease later develop nerve lesions. Until recently, we were unaware that the spinal fluid in certain cases contained active manifestations of the disease when the blood was negative. To-day it is possible, not only to demonstrate spirochetes in the spinal fluid, but also to treat this important field with most promising results.

Tertiary lesions in the nose and throat require early diagnosis for two highly important reasons: first, because their presence demonstrates an active syphilitic process in functionally important organs, and, secondly, because the general systemic infection causing localized symptoms in the nose or throat may later develop still more serious lesions in the central nervous or arterial systems. Specific manifestations in the larynx, soft palate and nasal septum are rapidly destructive; thus it is highly important that they be recognized and properly treated before actual destruction takes place.

In certain virulent cases the destruction of these delicate organs is a matter of hours. From twenty-four to seventy-two hours may cause sufficient destruction to seriously impair their function for all time.

Thus salvarsan, despite its marvelous rapidity and efficiency, can avail nothing if destruction has taken place before the diagnosis is made and the treatment given.

Symptoms of tertiary syphilis in diseases of the nose and throat include all manifestations of the disease which are of a destructive nature, and are not necessarily limited to the time of appearance with reference to the initial lesion. It is possible to have primary, secondary and tertiary syphilis at one and the same time. For example, an untreated chancre of the lip may develop into the malignant type and cause deep ulceration. When such a lesion is present, the delay in treatment allows a systemic infection which gives rise to secondary symptoms in the glands, skin, throat, etc. The moment an initial or secondary symptom becomes destructive to any serious amount of tissue, the lesion becomes a tertiary one. Thus, we have to all intents and purposes all three stages present at one time, that is, the original site of the infection as the primary stage, systemic manifestations in the glands, skin, throat, etc., as a secondary stage, and a beginning destructive process in the initial lesion as a tertiary stage. In this respect, also, so-called secondary lesions of the cartilaginous septum, which are not uncommon and are rapidly destructive in their action, are not secondary at all, but are true tertiary lesions despite the fact that they occur in the interval commonly regarded as the secondary period. Practically speaking, however, tertiary symptoms include all manifestations occurring after the commonly accepted secondary symptoms have passed.

The ordinary tertiary symptoms in the field of the rhinologist and laryngologist are too well known to need further mention. In my opinion, they are far more common in diseases of the nose and throat than they are supposed to be. My experience and that of my friends has recently taught me to use great caution in making a diagnosis in a given case until syphilis has

been eliminated as carefully as possible. To further this end, instructions have been given to do a Wassermann test on every patient admitted to the wards of the hospital on my service, and on every operative case in the outpatient department wherein syphilis might enter as a complication.

From a purely scientific standpoint, latent syphilis cannot exist. An individual either has the disease or he is entirely free from it. If spirochetes are present anywhere in the system, he has syphilis. If no spirochetes are present, the opposite condition is true. Symptomatically, however, there is often a quiescent period in the disease in which no active lesions are present, regardless as to whether the Wassermann test is negative or positive. For want of a better term, we may usefully and properly refer to this stage of the disease as "latent syphilis."

Latent syphilis is a particularly important matter in nose and throat practice inasmuch as operations in that field may rapidly change the latent disease into a very active one. This has happened to me in both private and hospital practice and has caused considerable distress to the patient and anxiety to the operator. To operate on a patient with latent syphilis without knowledge of its presence is a serious error and one which should be guarded against to the best of our ability. Judging from my experience and that of other Boston rhinologists, I strongly believe that we have no moral or legal right to perform a destructive operation of any magnitude on the nose or throat until a Wassermann test has been made. If doubt still exists in our minds as to the presence of syphilis because of an uncertain Wassermann test, we must proceed still further and make other tests which have proved to be valuable agents in the diagnosis of this disease. Operating on a patient with latent syphilis has exactly the same effect as the so-called "provocative test," but unlike that procedure, it has no power to overcome the mischief it has liberated. One of my

cases, that of a catilaginous transplant into the nose, developed a tremendous syphilitic reaction within forty-eight hours. The patient had shown two negative Wassermann reactions, one six months and the other one week before the operation. Forty-eight hours after the operation, the wound showed evidences of infection. The inflammation was not especially active for the first few days, but then a marked redness and swelling developed, which extended to both orbits. It had every appearance for a short time of erysipelas. Ice compresses soon reduced the extreme swelling, however, and after several weeks of active inflammation the pus discharge ceased. Then the nose from the nasal bones to the tip became moderately swollen, with a shiny, fiery-red color which gave a most unhealthy appearance. Hot poultices were applied without the desired results. Several incisions were made with the hope of liberating confined pus. None was obtained. The shiny, red color and swelling persisted for over four weeks, then gradually subsided and never returned.

Young children who have inherited syphilis in either the secondary or tertiary stages are beginning to receive the proper attention which has previously been denied them. Many hospital clinics are now especially interested in this phase of the situation and astonishing results are being obtained. Of 111 cases admitted to the Children's Hospital in Boston, Lucas found 31 per cent. to have syphilis. Churchill, in Chicago, found over 30 per cent. These statistics led me to order a routine Wassermann test done on every child in my clinic who showed a tendency to chronic bone involvement, particularly of the mastoid variety. Since my connection with the Boston City Hospital, there have been many such cases and I am sanguine as to the results which may be obtained in this direction. In children, the Wassermann reaction is not at all to be depended on, particularly when bony tissue is involved. All the older symptoms in the skin, bones, teeth, eyes,

etc., must be carefully sought for in case the Wassermann test is doubtful or negative. Nasal symptoms are not uncommon in children. Three cases of suspected foreign bodies in the nose have come to my attention, all of which proved to be specific disease and not foreign bodies. In all three cases there was a fetid odor and increased secretion, but there was little or no swelling of the soft parts of the nose. This is the opposite condition to what is found in the case of a foreign body, and is a strong point in the differential diagnosis. On the whole, children react well to treatment in this disease.

The value of the Wassermann reaction depends on the period of the disease at which it is taken. It has no value in the primary stage. As soon as the disease manifests itself in the general system, it develops its full strength. The effect of previous treatment with mercury is to give a negative Wassermann reaction; hence, a negative test is not positive evidence that syphilis is not present. The effects of previous treatment, moreover, may extend over a period of years and give a negative test in the tertiary period. The situation is still further complicated because in the latter stage of the disease lesions in bony tissue have a strong tendency to yield a negative Wassermann test even in untreated cases. This is an important point in tertiary lesions of the nose inasmuch as such lesions usually occur in the bony tissue. The Noguchi test is practically the same as the Wassermann. A large number of the two tests were carried on together by Dr. Sanborn in the Boston City Hospital, and the results were equal in every way. On the other hand, the luetin test is occasionally positive when the Wassermann test is negative. In such an event, the result of the luetin test may be given the preference.

In the event of a doubtful Wassermann reaction, another method of diagnosis is available which is a positive sign when present. The bones may show certain characteristics which are distinctly syphilitic

The pathologic changes exhibit a variety of forms which, in exaggerated cases, may be determined by the sense of touch. There may be a distinct area of softening due to a broken-down gumma, or a thickening or roughness which may be determined by the fingers. The Roentgent ray will determine less-apparent lesions in the bones to the expert who is able to read them accurately.

Periosteal thickening may be circumscribed, single or multiple, and the thickened periosteum may be on one or both sides. Endosteal thickening, while less common than periosteal, is occasionally seen and when present is strongly diagnostic of syphilis. Dactylitis in children may be looked on as a very possible symptom of the disease. Specific bone lesions are not limited to the long bones but may occur in any part of the osseous system. Specific infection in the ribs and rib cartilages is not infrequent.

In the cartilaginous rib transplant case previously mentioned, which Dr. Emerson and I performed together, the cartilage obtained from the sixth rib showed marked signs of having been diseased. We supposed at the time that it was sufficiently healthy for the purpose because of the negative Wassermann reaction. As a matter of fact, it did finally graft into place, but it required over three months to do so. I doubt, however, if the long inflammatory period was due to the cartilage, but to the extreme irritability of the tissues surrounding the cartilage when placed in its altered position.

Syphilitic bone lesions are particularly valuable guides in diagnosis for the reason that such infections are prone to give negative Wassermann tests. Expert syphilographers assert that perhaps not more than one case in three of bone syphilis exhibits a positive Wassermann. This phase of the situation is especially important to rhinologists, because a false diagnosis is easily possible if a Wassermann test alone be depended on.

A number of cases in the hospital which have given negative Wassermann tests have yielded quickly to salvarsan. One case of multiple sinusitis was negative to a provocation test, but immediately showed great improvement after the test was made, owing undoubtedly to the small dose of salvarsan given in the test. In fact, this particular patient was practically cured by a procedure which was instituted wholly for the purpose of diagnosis. From a diagnostic standpoint, it failed utterly to demonstrate a syphilitic process; but, for the time being, at least, it cured the patient's headaches and dried up a pus discharge which had been continuously present for many months. Another patient who had had several frontal-sinus operations (one of them a complete Killian) failed to respond to treatment for many months. The case occurred a year or more before salvarsan was known. Later it was one of the first cases of its kind treated with salvarsan in our hospital, and the results were most satisfactory.

The provocative test consists of giving a small dose of salvarsan and then making a Wassermann test. The theory is that the salvarsan breaks down the walled-off process and allows the spirochetes to enter the circulation. Bone lesions, in particular, respond to this test and it is an extremely important factor in nose and throat diseases for this reason. In my opinion, all chronic sinus cases should be given this test in the event of a negative Wassermann before any extensive operation is attempted. I know of two cases, which later proved to be specific, in which extensive and mutilating operations were performed on the nose and face. They occurred before the day of this test; but had it been available, both operations might have been unnecessary. In another recent case in which there are decided nasal symptoms, there was a negative Wassermann, but the history of the patient gave the father's death as due to locomotor ataxia. This clue to a possible specific taint was deemed sufficient

to demand a provocative test. At the time of writing the result is unknown.

Acute postoperative reactions of a syphilitic nature are not as common as we might suppose. They do occur with sufficient frequency, however, to make them an important element in our work. I have actually seen but few such inflammations following septal operations. I have had two such reactions in private practice following sinus operations and two following cartilaginous transplants. In the latter, one patient previously mentioned had two negative Wassermanns before the operation. The other patient gave the cause of her nasal deformity as traumatic in its origin and we took her word for it. A violent reaction took place and persisted for many weeks. At first, we viewed the situation as an ordinary infection and treated it as such without relief. Finally, in desperation, we tried a Wasserman reaction and found it three plus positive. The case reacted well to salvarsan, but in spite of that treatment repeatedly given, combined with mercury, the Wassermann reaction is still positive though the wound has long since healed.

In the hospital clinic, a considerable number of sinus cases refused to clear up well after operation. The patients continued to have pus, granulation tissue and headaches in spite of continued operative treatment. Later, salvarsan was given with most satisfactory results.

My attention was recently called by Dr. Sanborn to tonsil operations in syphilitic patients. It appears that a considerable number of such patients have been operated on with decidedly harmful results. Dr. Abner Post, who is known the world over as an authority in all matters pertaining to syphilis, informed me in a recent conversation that many children with hereditary syphilis are operated on for adenoids and the results of such operations are very injurious. Dr. Post further called attention to the fact that children with hereditary syphilis usually present the picture of

adenoids and are thus liable to have such operations performed on them even if no adenoid tissue is present. I know of no special case of either adenoid or tonsil operation on a syphilitic subject. Doubtless such cases have occurred but I failed to recognize them.

Occasionally, for no apparent reason, an inflammatory process will follow operations on the nose or throat. We have previously supposed that such an acute reaction was due to an ordinary infection. Doubtless, some of them were syphilitic patients and that disease was the primary cause of the postoperative inflammation. Here arises another phase in the situation which is new to me.

It appears that postoperative inflammation, either acute or semiacute, is not alone due to syphilitic infection but to a double infection. In very destructive lesions, it is not the spirochetes alone which destroy the tissues, but other pus organisms which are also present acting in conjunction with them. For example, in the event of an ulceration of the larynx or the cartilaginous septum, the spirochetes attack the structures to the extent of greatly reducing their vitality. Into this fertile field come other germs of a virulent nature, and an exceedingly destructive inflammation results. This theory is proved by the evidence of systemic infection which is often present. If the case were one of the spirochetes alone being active, temperature and symptoms of septic absorption would not be present. Doubtless, when the inflammation is chronic and not especially active, either the spirochetes are acting alone, or with other bacteria of a low-grade variety. In chronic sinus cases, probably, both spirochetes and low-grade pus organisms work together, as the semiacute inflammation is too great for the spirochetes alone and too slow a process for organisms of the streptococcus variety.

Whenever a postoperative inflammation develops in our field, it is well to have a Wassermann test made immediately. If the seat of inflammation is in the soft

palate, larynx or septum, the destruction is so rapid that permanent injury will result very quickly. Twenty-four hours' delay in accurate diagnosis may result in great deformity or loss of function before the proper treatment is given. I know of one case in which both sides of the mucous membrane sloughed away in twenty-four hours from a postoperative syphilitic inflammation following a septum operation. This was a case of latent syphilis presenting no evidence of the disease prior to the operation, but a very active process set in immediately afterward. Salvarsan speedily overcame the inflammatory reaction, but was given too late to prevent a large perforation.

The profession still has much to learn about syphilis. Many marvelous cures have been made, so far as symptoms are concerned, but who can tell of one patient who is cured for all time? Cases are known which after having been treated with salvarsan gave negative Wassermann reactions and the patients were supposedly cured, yet later developed most serious nerve lesions. At present, the question of cure is unknown. Expert syphigraphers feel hopeful regarding patients in whom proper treatment has been given in the primary or early secondary stages. A number of such individuals have had reinoculations of the disease, which naturally is the best possible indication of a permanent cure. It is doubtful, however, if reinoculation ever occurred in the tertiary stage of the disease.

Salvarsan alone is not to be relied on. Mercury must be used in conjunction with it over a long period of time. A negative Wassermann reaction, after treatment, by no means indicates that a cure has been effected. Every syphilitic patient must be under observation for a longer period of time than salvarsan has existed as a specific remedy before any definite opinion may be given as to the final outcome of the case. The proper diagnosis and treatment of syphilis is a specialty by itself. The average physician, surgeon

or specialist has too little experience with the disease to care for patients who are so afflicted, and it is far too important a matter for half-way measures in the hands of physicians of limited experience with this particular disease. The rhinologist and laryngologist should learn as much as possible of the syphilitic lesions which develop in his daily work; but very few specialists in this field are good syphilographers; consequently they should, if possible, refer such patients to other physicians whose experience has fitted them to be well versed in this very important branch of medicine.

In closing, I wish to express my sincere thanks to Drs. Post, Sanborn, Whitney, Nichols, Howard, Cotton and Herman, all Boston physicians and surgeons of wide reputation in their special fields of work, for the information given me pertaining to this subject.

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ABSTRACT OF DISCUSSION

DR. JOSEPH C. BECK, Chicago: The most important point, perhaps, is that there should be a routine Wassermann test on every patient we are going to operate on and I am thankful Dr. Borden brought up this question. It is not difficult to have a routine Wassermann reaction at this time and by it we may be spared a good many of the complications that Dr. Borden has mentioned. With regard to tertiary syphilis and gumma, being so early as mentioned by Dr. Borden, I think that is not to be expected, as these changes take considerable time; for instance, endarteritis. The aid of the Roentgen ray, as Hickey of Detroit brought out in connection with disease of the tibia, is important. Even in the presence of a negative Wassermann, thickening is frequently found on the anterior portion of the tibia. The provocative test has been a disappointment to me in a large measure, though in some cases it may be a help. Last year, in our discussion, the point was made that we should be criticized for a perforation in the septum after a submucous operation, and I know of an instance in which a statement of that kind resulted in considerable trouble to a physician when the result may have been due to syphilis and not to any fault of surgery. With regard to transplants, I have had the same thing happen that Dr. Borden mentions; not with cartilage, but with bone; I never use cartilage because it becomes absorbed; but using the rib I had a condition of that kind.

DR. W. W. CARTER, New York: I wish strongly to endorse the point made by Dr. Borden with reference to the operations on bone in syphilitic subjects. I have had much experience in the transplantation of bone in the correction of nasal deformities and I have always endeavored to be absolutely certain that no active syphilis was left in the patient who was to be operated on. I have had in nearly all my cases two Wassermann tests made; but on three occasions, even after two Wassermann tests had proved, as much as a Wassermann can prove, that syphilis was absent, I had failure in transplantation of the rib for nasal deformity. The failure was not due to extraneous infection but to the effect of the syphilis on the tissues in which the transplant was made. The effect is very distinctive of syphilis at the location where the bone was placed. It did not show a purulent infection, but the tissues were very much thickened, discolored in a peculiar way, a sort of bluish red, and at first a serous bloody discharge came from the area where the transplant was placed. Subsequently this became infected and the transplant had to be removed. In each of these cases there was evidence in the rib, when I cut down on it, that the patient had been thoroughly saturated with syphilis. The rib was almost entirely cancellous tissue, and you will find in the old syphilitic cases that the bone has this appearance; the amount of compact tissue in the rib is very much diminished. I split the rib and scraped out the cancellous tissue and in this case the compact bone left was almost as thin as tissue paper. We should not do any bone operation in a case in which we are not absolutely certain that there is no syphilitic infection.

DR. JOHN O. ROE, Rochester, N. Y.: I agree with Dr. Borden in every particular, excepting the necessity of making a Wassermann test before all nasal operations are undertaken, which he so strongly advises. Such a test should certainly be made in all cases of suspected lues, or in all sinus operations, in which the cause of the trouble might be in doubt, but to lay down the hard and fast rule that it should be made in all cases before all simple operations, when there is no history or suspicion of a specific complication or association, would be not only unnecessary, but also might often give a critical or designing patient an opportunity to interfere with the success of the operation. By way of illustration, if a perforation followed a submucous operation, when the cause of the deviation was unquestionably traumatic, or if unexpected complications should arise, the omission to make the test in compliance with a fixed rule, would again give the patient an opportunity to make trouble for the surgeon. There is, however, one class of cases in which a Wassermann is of great assistance and usually a necessity for the surgeon to determine the presence or absence of any

active manifestation of a specific nature. This is in those cases of nasal deformity, attended with more or less destruction of tissue, the result of specific causes. Before undertaking any plastic operation in these cases for the correction of the deformities, it is important to determine the presence or absence of any activity of the constitutional disease.

DR. JOHN F. BARNHILL, Indianapolis: I wish especially to commend that portion of Dr. Borden's paper which tells us that we should be cautious to learn all there is to know about our patients before we operate. I have seen two patients in the last ten years who have been seriously injured by operative procedures having been carried out while a syphilitic condition was present. One young lady completely lost her nose as a result of such an operation. I saw recently a child 13 years old on whom some tonsil work had been done. The child had lost pretty nearly all of the soft palate and a portion of the hard palate as the result of the operation, which was unwarranted because of the condition of the child. As a rule laryngologists are not so cautious in the preparation and examination of their patients as the general surgeon is. It is pretty certain that a patient can drop into almost any laryngologist's office and get a septum operated on or the tonsils removed, or almost any other thing done in the nose and throat on the same day he comes, provided the laryngologist has the time to do it. Dr. Borden's paper, I think, warns us very decidedly against this procedure. We have perhaps seen where we might have been benefited had we followed the advice he has now given us. He goes rather far, perhaps, in stating that latent syphilis is always, if I understand him right, a contra-indication to any sort of operative work in the nose and throat. If such were the case I am sure that all of us would have had many more calamities than we have had, because all must have frequently operated on these patients without any knowledge of the presence of a latent syphilis. I recently saw a case of well-marked tertiary syphilis in which several physicians of repute had repeatedly examined the throat without discovering the presence of a latent lues of the soft palate. This patient had apparently been well for a long time. I think this must be quite a common experience.

DR. OTTO T. FREER, Chicago: I agree with Dr. Roe that to ask for a Wassermann test before every nose operation would be an excessive and unreasonable demand. We should, however, as heretofore, always be on the watch for syphilis. I wish to call attention to the deceptive nature of the frequent mild and very slowly destructive forms of tertiary syphilis found in the nasal cavity and which contradict the common belief that tertiary syphilis in the nose is always a rapidly destructive disease. A common type of mild tertiary

nasal disease is smooth infiltration of one side of the septum which exaggerates existing ridges or slight deflections into the appearance of a pronounced septal deviation with occlusion of the affected naris. The mucosa over the swelling is smooth, pink and deceptively normal in appearance. Minute inspection after adrenalin shrinkage, however, almost invariably discloses a small shallow ulcer or granulating patch, while the absence of a concavity of septal deviation in the other naris excludes a true deflection of the septum from the diagnosis. Two such patients have been sent to me for a submucous resection. Another form of mild hypertrophic tertiary syphilis is syphilitic hyperplasia of the inferior turbinate. It may so strikingly resemble the ordinary finely nodular true hypertrophy that it may be mistaken for a catarrhal product. Here, too, the presence of slight ulceration somewhere is usual and gives the clue to the nature of the affection. A third type of non-destructive tertiary syphilis is indolent ulceration of the vault of the nasopharynx. There is no clean-cut destructive ulcer such as text-books describe as typical, but instead a granulating, ill-defined superficial one resembling degenerating adenoid remnants in the adult. I have seen grave cerebral syphilis with paralysis of the abducens and facial nerves of one side, headaches and symptoms of the syphilitic pachymeningitis follow a syphilitic infiltration of the pharyngeal vault of this kind, and think that the diseased area was continuous with gummatous products above it in the middle cranial fossa, communication taking place through the foramina at the base of the skull. The three conditions I have described are not rare and should be watched for.

DR. E. J. BERNSTEIN, Kalamazoo, Mich.: I think we should thank Dr. Borden for calling our attention to the fact that we ought to make a Wassermann test very frequently, but it seems to me to be going too far to say that we should have a Wassermann in every one of our nasal operations, for, if that were true, and we go on record that such should be done, a lot of disastrous results may happen if it is not done, and it is practically impossible in every case. If it were absolutely true that we run such a great risk, what in the name of common sense would account for our good results that we have been having in our operations for the past ten or fifteen years? I recall a case in point in an actively syphilitic patient, a man with an ulcerated nose. I had a Wassermann test which was negative. He had occlusion of the nares, which I thought might be the cause of the ulcer, in view of the negative Wassermann. I did a submucous resection of the septum and got a perfect result. I have no doubt many could recall similar experiences.

DR. HENRY HORN, San Francisco: An interesting thing about this discussion has been the extremely pessimistic

way in which every one has spoken of the Wassermann reaction as an aid. A series of experiments has been carried out by a neurologist in San Francisco, who has found, as have many others, that the Wassermann reaction is a help when positive, but, when negative, absolutely not to be depended on in a great proportion of cases. Very recently, a Wassermann reaction was taken on a certain patient in which the blood was divided into two parts and both specimens were sent to the same laboratory; one came back with a negative report and the other positive. A point I would make is that we are too apt to depend on the Wassermann reaction. I simply sound a note of warning in this respect. I would call attention to three manifestations of tertiary lues: first, a peculiar, dry, postnasal catarrh, which is a latent syphilitic manifestation; a dry, shiny catarrh which doesn't respond to treatment. In these cases if we employ salvarsan we get rapid results. Secondly, a hypertrophic postnasal catarrh, like a pharyngitis granulosa. Thirdly, a peculiar type of antrum trouble, a non-infectious type in which the antrum is filled with a clear, non-purulent mass, of a gelatinous consistency that is easily overlooked in the washings.

DR. HUDSON MAKUEN, Philadelphia: I report a case illustrating the importance and the unreliability of the Wassermann test. The patient, a beautiful child of 4 years, came to me with an aphasic condition. He developed speech normally at 2 years; could say such words as automobile, elevator, etc., but gradually lost speech entirely and at the age of 4 was aphasic. He had been examined previously by several physicians and one had diagnosed his case as of muscular dystrophy. Not only was there aphasia, but the condition simulated juvenile insanity; the child had no concentration; paid no attention to anything brought before him. His father and mother came to town and I found that the father was in the first stages of paresis; all his muscles were affected. He was referred to the neurologist and it was decided to use the Wassermann test. I was told that it had been used six months before with negative results, but at this time he showed a positive reaction and that gave us a clew to the child's condition. We then had a Wassermann test on the child, and also included the mother. She was a nervous woman with various vague complaints, and she gave a positive reaction also, while the child gave a negative one. Notwithstanding that fact, we all concluded we were dealing with a syphilitic child. I mention this case to show that the one in which we should have expected a positive reaction gave us a negative one, while the mother who had no very marked symptoms gave a positive reaction.

DR. P. SCHOONMAKER, New York: The Wassermann test would be of far greater value if its findings were more definite. While the double positive reaction shows a syphilitic

infection, a negative does not assure us that the disease is not present. Only recently I had an adult with nasal obstruction due to a badly deflected septum requiring an operation for its correction. He was rather pale and anemic, the functions of the body were normal, history negative, and no symptoms of a systemic infection. I considered his condition due to the deflected septum causing poor aeration. A submucous resection was done, the result being excellent, there being no perforations or lacerations. The coaptation of parts was perfect. The nares were packed with aseptic gauze holding the parts well together; packing was removed in forty-eight hours, parts looked healthy. The patient did well for four days, on the fifth day the septal wall looked bad, and a day or two later the entire septal wall in site of operative field sloughed, leaving a large perforation. At this time a swelling in the nasopharynx was discovered. I was at a loss to account for this condition. Suspecting that latent syphilis might be present I had a Wassermann test made, which was negative. Nevertheless I put him on a mixed treatment and asked for consultation. Two specialists in rhinology saw him with me, and notwithstanding the history and negative Wassermann concurred in the opinion that the condition was one of tertiary syphilis and advised appropriate treatment. Under full doses of mercuric iodid and potassium iodid saturated solution, in increasing doses, up to 35 grains three times a day, there was rapid improvement in his condition. Wound healed nicely, the general health was better and case soon cleared up. The patient gained in weight and strength and said he never felt better.

DR. NORVAL PIERCE, Chicago: I have operated on syphilitic noses and have had just as good results as in the non-syphilitic cases. I do not mean that we should operate in the presence of active syphilis. I had one patient, a young woman, unmarried, anemic, undoubtedly virtuous, who had recurrent hemorrhages from the nose. The epistaxis was due, as I thought, to a deflection of the septum; there was an erosion of the septum on one side. After the deviation was corrected everything went all right until about a week after the operation when she had a violent hemorrhage from the nose which came from some point well back and was very profuse. The nose was packed, the hemorrhage ceased and the patient recovered. A short time after that she came into the hands of Dr. Webster suffering from menorrhagia. He eventually performed a hysterectomy and found, on section of the uterus, a marked endarteritis. He informed me that there had been two Wassermann tests, both positive. I believe hemorrhage from the nose in children is suspicious. I have had recently two cases of ordinary epistaxis, in one of which, knowing the father to be a man of very liberal habits in his youth, I had a Wassermann done, and while

he had no symptoms of syphilis, there was a marked positive reaction in the child. May not these be cases of syphilitic endarteritis very often? I think, however, it should not go forth from this section as our opinion that we should have a Wassermann test before every nasal operation.

DR. L. W. JESSAMAN, Framingham, Mass.: I reported a case in a colored woman with sinus trouble seen three years ago, in which no history of syphilis could be obtained. A few days later the patient developed a swelling at the inner canthus of the right eye and a diagnosis of ethmoiditis was made. She was operated on, the ethmoid cells cleared out and the patient did well until some time afterward when she returned with a swelling at the lower margin of the left orbit, and another on right side of nose below the lower margin of the orbit. A diagnosis was then made of gumma, and the condition was very quickly relieved with the administration of mercury and potassium iodid.

DR. DUNBAR ROY, Atlanta: In my clinic in the South I have a great many negroes, and syphilitic manifestations in the nose and throat in this class are very prevalent. The northern men hardly know what these manifestations are until they have seen these cases in the South. You can find the lesions from the nose down to the epiglottis, but I rarely ever see a gummatous condition in the larynx. I never find the epiglottis entirely ulcerated away. Another point I would call attention to is to have a Wassermann test made in the cases of vasomotor rhinitis that come to us. In three out of ten such cases of engorgement of the nose, I have found a late secondary manifestation of syphilis. I always have a Wassermann made in these cases and it is surprising how they will yield to antisyphilitic treatment. I believe in a large number of these cases there is a syphilitic basis.

DR. EMIL MAYER, New York City: A woman came to see me with the story that she had been under the care of some of our best physicians and that they had diagnosed a condition of gall-bladder trouble. She wanted me to give her the address of another man to consult, and said, incidentally, "I have a little sore in my nose. Would you look at it while I am here?" I made a nasal examination and said, "I think you will find the whole cause of your trouble due to this condition in the nose." I sent her for a Wassermann test and, as I suspected, it was positive.

DR. JOSEPH C. BECK, Chicago: I hope I did not give the impression that I think it is necessary to have a Wassermann test in every case of nose or throat operation; only in suspicious cases in which the findings are not definite of lues.

DR. C. R. C. BORDEN, Boston: Someone has taken the ground that I overestimate the importance of latent syphilis. Last week at the meeting of the Laryngological, Otological

and Rhinological Society I was asked how I dared etherize a patient who had acute congestion of the kidneys. I would have much less fear of such a kidney complication than I would in operating on a patient with latent syphilis in a delicate organ of special sense. In answer to Dr. Bernstein, doubtless a great many nose and throat operations have been performed with splendid results with no trouble from active or latent syphilis. On the other hand, serious complications have been known to follow in a sufficient number of cases as a result of syphilis to make it worth while to use proper precautions in all serious cases. I hope I have not given the impression that I have much faith in the Wassermann reaction, for I have not. I went through a great deal of trouble to get the latest ideas of the leading Boston syphologists on the subject under discussion in order that I might present the other methods of diagnosis which are available for syphilis. Taking the subject as a whole, I appreciate the fact that it is not possible to have a routine Wassermann in every case, but all the larger hospitals are rapidly coming to it. We must consider that syphilis is a wide-spread disease and one which is the real cause underlying many diseased conditions in every field of medicine. Of course, in private practice, it would be impossible to have a routine Wassermann in every case, but in operations which are very destructive or mutilating a Wassermann test should always be done first. In fact, in my own experience, the procedure of the Wassermann reaction has more than once made such operations unnecessary.

THE RECONSTRUCTION OF THE NASAL SEPTUM AFTER THE SUBMU- COUS OPERATION

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The reconstruction of the nasal septum after the submucous operation invites, first, a discussion from both the physiologic and the anatomic standpoint of the etiologic factors of nasal disturbance for which septal relief is indicated, and justification of the selection of surgical interference in the septum rather than other parts of the rhinopharyngeal tract; second, the adoption of surgical measures which will reasonably overcome the nasal disturbance with the least traumatic modification, and, third, the reestablishment of normal function in the part itself and the correction of the disturbed specialized function to which its displacement has contributed.

Succinctly stated, the consideration devolves on the three questions: For what may submucous resection be legitimately done? How can it most safely and simply be performed? How perfectly may the septum be reconstructed? Such reconstruction must include the anatomic rebuilding of a structure virtually razed to its foundation, the physiologic continuance of its general and specialized function and, finally, the relief in satisfactory measure from the conditions for which it was instituted.

The new partition must enable the septum to perform its part in the secretory, olfactory and respiratory activity of the nose, be anatomically strong enough to withstand reasonable subsequent trauma, preserve the alignment of the external nares and resist unfortunate sequelae.

Interesting results were reported by Anderson¹ from animal experimentation in obstructing the upper respiratory tract, proving that nasal obstruction leads to death or serious modification of vitality. It furthermore produces lowered resistance, predisposition to infection, local disease of the respiratory tract and associated cardiac, skin and pulmonary symptoms. He even produced asthma symptoms in the lower animals and found that reopening of the nose relieved them.

Consideration of this topic has been induced by a rather careful analysis of the procedures and subsequent results of about five hundred complete and partial submucous resections which I have performed, and by the rather fortunate opportunity, as will be later explained, of having obtained a septum specimen by secondary operation in which surgical and physiologic points of interest resulting from primary interference were well exhibited.

Obstinate catarrh, the neuroses of hay-fever or asthma, nasal stuffiness, eustachian tinnitus and sinus pressure are classical symptoms for which orthopedic correction of a deflected or nodular septum might be indicated. Here the personal equation of the specialist's examination must be severely eliminated, nor must the operator be influenced by the readiness and skill of his own preference for this operation. Surgeons subconsciously allow their minds to become focused on certain types of work, and it is difficult to escape the influence of this in their operative advice. The delicate decision as to the possibility of restoration in a middle turbinate showing early degeneration may frequently be the determining decision as to an operation on it or on the encroaching septum. A careful review of the physiology of these areas would indicate a preference for septal rather than turbinate interference.

Mentzenbaum² is of the opinion that the extirpation of the turbinate destroys an important vitalizing

1. Anderson: Proc. A. L. R. and O., 1909.

2. Mentzenbaum: Cleveland Med. Jour. and Laryn., 1914.

organ in the nose, but the splendid work of Mosher and others need not be discussed here.

Phillips³ classifies cause of septal deformities as due to congenital malformations, arrested or excessive development of the facial bones and traumatic injury, with large majority in the latter, and quotes the importance of the progressive changes due to unrecognized childhood traumatism. It is doubtless due to the insidious development of such disturbance that the many conditions indicating septum operation are suddenly revealed and apparently almost spontaneously.

As Emerson says,⁴ the patient consults not for the deflection, but for the conditions which have produced unequal ingress of air, hypertrophies, contact, insufficient drainage or active infection of the sinuses and the nasopharynx. He further enumerates asthma, headaches, aprosexia, disturbance of vision, aggressive otitis media, erysipelas from the infection of the erosions, eczema of lip, recurrent bronchitis, chronic nasal pharyngitis, redness of nose, aphonia, perversion of smell and taste, dyspepsia, mechanical obstruction and catarrh as symptomatic of septal deformity.

To this might be added Bryant's⁵ conclusions that epileptic seizures are more often due to reflex stimulus from the schneiderian membrane to the fifth nerve than from other causes.

A most frequent indication for careful examination of the upper nasal cavity is a simple, indefinable stuffiness in that area, subjecting the patient to varying degrees of discomfort. Though indefinable, its degree of oppression is in sharp contrast to the unmeasured relief by removal of its cause. In a minor percentage of cases, hay-fever and asthma are relieved and occasionally entirely overcome if the obstruction be a sharp bulge or ridge constantly irritating the middle turbinate. Frontal and ethmoidal sinusitus, especially in

3. Phillips: Diseases of the Ear, Nose and Throat.

4. Emerson, Francis P.: The Results of the Operation of Submucous Resection of the Septum in Private Practice, THE JOURNAL A. M. A., Oct. 22, 1910, p. 1449.

5. Bryant, Med. Rec., New York, 1907; Boston Med. and Surg. Jour., 1911.

those cases with recurrent attacks, have sometimes been eradicated by the correction of a markedly deformed septum. Hay-fever and asthmatic seizures, always problematic in prognosis, sometimes permanently change, and a most encouraging picture is seen in the return of normal luster to the mucous membrane.

As cited by Ballenger,⁶ an irregularity of the septum *per se* should not indicate a submucous operation. The obstructive and irritative conditions present, combined with the symptoms enumerated above and obviously connected therewith, render the situation clear, though with one's tendency to become subconsciously focused in a certain type of work, possibly only a complete examination by an "all-around non-operative specialist"—if such hypothesis be possible—should determine in certain cases whether interference with the septum or the turbinate would be the more justifiable.

It is justifiable to associate ordinary postnasal catarrh with deformities in this area, especially those without adenoids, but with ridge, spur or deflection. Here must be carefully analyzed evidence of atrophic mucous membrane change, as the too-wide nasal cavity is one of dread. It might be suggested here that a careful subsequent review of patients some time after the septum operation should be instituted for possible sequelae of this sort.

A certain number of cases present a symptomatology of general defective metabolism—the stasis of gouty diathesis, sallow skin, foul breath and coated membranes. If these be associated with poor aeration of the upper respiratory passages, the obstructed nares may be a positive factor.

Richardson⁷ has reviewed the connection of upper respiratory disturbance as a reflex of general body condition, counseling against undue haste for operation and early attention to dietary and hygienic reor-

6. Ballenger: Diseases of the Ear, Nose and Throat.

7. Richardson, Charles W.: Some Suggestions in the Methods of Correcting Deflection of the Nasal Septum, THE JOURNAL A. M. A., Sept. 21, 1912, p. 1131; Proc. A. L. R. and O., 1913.

ganization, while Meyer reports treatment of ninety-three cases of nasal vasomotor disturbance by topical application for relief of dysmenorrhea.

Favorable result of septum replacement has been the experience of many of us in the relief of eustachian tinnitus, especially that associated with a posterior exostosis or hook-like projection of the vomer. The rationale of these improvements has been analyzed by many investigators, Leland⁸ urging the freeing of the fossae of Rosenmüller of synechial or isolated patches of lymphoidal tissue at the onset of earache, and Norval Pierce,⁹ carrying the investigation further into the physical and physiologic factors involved in the diminished tympanic cavity, retraction and atrophic condition of the drum with ankylosis at the foot of the stapes. Changes in blood-supply with hyperemia and rarefaction of air explain the situation here and make septal replacement one of the positive elements in physiologic reconstruction.

Relief of eustachian catarrh and remodeling of the air-current with freedom through the tract of the pharyngeal tonsil area is a particularly favorable result. If we accept the theory suggested by Dr. Randall that the adenoid tonsil may be increased by obstructed nares, as well as the reverse, the change in rôle sometimes becomes explainable.

The extensive relation of the septal tract with eye affections forces a close connection of ophthalmologic and rhinologic fields. Hilcher¹⁰ quotes a varied field of optic conditions—rebellious headache with eye pains, accommodative asthenopia with neuroretinitis, catarrhal conjunctivitis, recurring phlyctenular keratitis and dacryocystitis—as indicating an examination for nasal obstruction, while we receive constant reference of cases for study in this tract of involvement of the optic nerve.

Thus explained, the review of functional and pathologic lesions is pertinent to the topic, for their correc-

8. Leland: *Laryngoscope*, 1909.

9. Pierce, Norval: *Laryngoscope*, 1909.

10. Hilcher: *Northwest Med.*, 1909.

tion, as above stated, is essential to our propaganda of reconstruction.

Reverting now to the consideration of operative technic and the sequelae, positive and negative, certain localized phases of operative surgery in the rhinopharyngeal tract have become, within the past few years, most highly developed from an operative standpoint. The surgery of the nasal septum, the middle turbinate and ethmoidal sinuses, the pharyngeal orifice or the eustachian tube and the maxillary antrum have particularly shared in this progressive development—in fact, have become so specialized as to be associated with the name and procedure of certain eminent clinicians.

We may assume that those who skilfully and readily work beneath the perichondrium will elect this form of relief or its modification in preference to the varied procedures by saw, chisel, knife, electric burr and cautery.

Perhaps the most common type of deviation, presenting a frequent result of unrecognized traumatism, is shown in Figure 1, with a high bulging to the right and compensatory sweep below and overdevelopment of the ridge on the left. This simple form of deformity indicates but little explanation with the elaborate directions of Freer, Ballenger and others and the marvelous armamentarium provided therefor.

Figure 2 presents a type considerably more difficult, with a double compensatory vertical sweep, while in Figure 3, with both anterior and posterior nodular deformities, frequently invisible behind until the turbinates are well shrunken, is portrayed a type of disturbance most gratifying in its relief but frequently neglected or overlooked by the comparatively inexperienced nasal examiner.

As bewildering as the attempt at matching striped blades of oriental grass is the analysis and classification of irregular types of deviation. In the more intricate forms the assumption is justified that the skilful

operator must be a mechanical expert, and I recall the ingenious suggestions of bevel saw and the button and ligature retention.

In my experience, perhaps the most successful nasal reconstruction resulted from three distinct operations: first, the removal of a vertical strip of cartilage, 3 or 4 mm. in width, from the anterior right nares to relieve the dislocated end of the triangular cartilage; then leaving a column which happened to remain in the median line, a formal submucous resection posteriorly on the left side for high compensatory bulge, and finally an external nasal operation which consisted in chiseling the nasal process of the superior maxillae on either side and swinging over an atrociously deformed external nose. The newly-constructed organ was of normal contour with evenly divided internal nares; there was restoration of the normal membrane, and a marked subsidence of eustachian symptoms which had well-nigh become organic.

In discussion of the operative technic, a successful replacement of the septum requires certain fundamental operative rules, and these are harmonious with the general principles of surgery: First, traumatism should be reduced to the minimum degree. This would mean an incision involving the simplest linear space. An increasing tendency in all general surgery would seem that of allowing sufficient room for careful observation, and the suggestions of Yankauer, Butt¹¹ and others for continuing this incision well over the angle of the floor is compatible with safety. Such an incision should be thoroughly carried to the cartilage. To the experienced operator, the feel of the knife will be a guide to the depth of the incision, as slight grooving in the cartilage can do no harm and emphasizes the depth.

The important circulatory channels, even though nasal anastomosis is most kindly, should be preserved and delicate nerve fibrils in the mucous membrane

11. Butt: *Med. Times, Laryng.*, 1912.

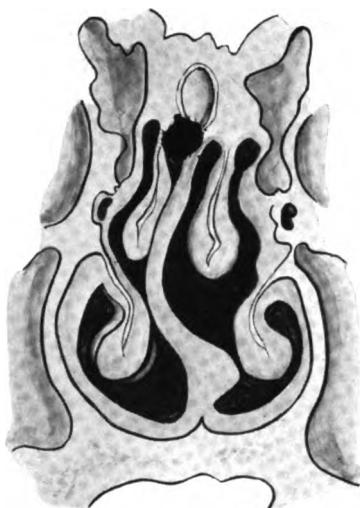


Fig. 1.—The most common type of deviation of the septum presenting a common result of unrecognized traumatism.



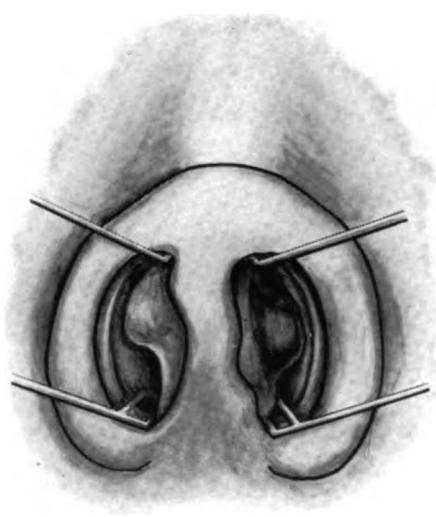


Fig. 2.—A type of deviation with a double compensatory vertical sweep.

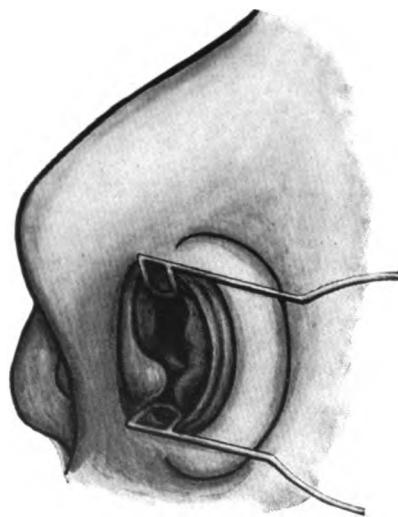


Fig. 3.—A type of deviation with both anterior and posterior nodular deformities.

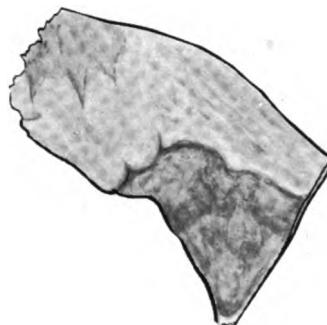


Fig. 4.—Portion of septum containing the segment from the posterior smooth end of which the section (Fig. 5) was taken.

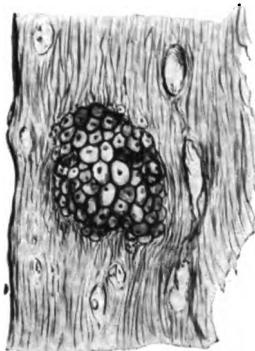


Fig. 5.—Slide showing fibrous tissue interspersed with vascular spaces, a certain amount of granular tissue and a well-formed nest of young, growing cartilage-cells.



retained. The extent of operation, while only absolutely completed, as Freer¹² suggests, with all vestiges of bone deviation removed, should nevertheless not pass to the point of requiring unnecessary supportive splint pressure. A patient's recuperative condition must be considered, his limit of shock should be appreciated, the possible devitalizing of tissues from excessive topical shrinking, and anesthesia must be kept within bounds; while hemorrhage, apparently alarming, is really inconsequential. In correlation with other major operations, it cannot be of advantage to wound vessels and bony structure to the extent of causing copious bleeding.

In order to fulfil these conditions, I am inclined here to follow my custom in tonsillar operation and reduce the instrumentarium to the minimum. While most elaborate and ingenious instruments have been devised for meeting the varied forms of all angular exigency and distortion, few septal operations really require more than half a dozen well-selected instruments, and this selection is designed to be compatible with the after-results required.

Freer's half-round-bladed septum knife, double-ended separator and reinforced edge retractor, Ballenger's swivel knife, Brünig's forceps for the perpendicular plate of the ethmoid and vomer, Schwartz' chisel for anterior ridge and Watson's small nasal speculum would complete an outfit and serve in everything but an exceptional case.

I am accustomed to use a simple septal knife, then a double-sided spatula of Freer, using the dull end to lift the membrane, then sliding the sharp end of the spatula obliquely through the cartilage, which I have not once perforated since the adoption of this method. The operation is then carried backward with gradual lifting of both perichondrium and periosteum, completing the first step as near to the floor and anterior

12. Freer, Otto T.: *The Nasal Septum; A Description of the Author's Present Manner of Performing the Window Resection for Deflections*, *THE JOURNAL A. M. A.*, Sept. 30, 1905, p. 985.

and posterior extremities as possible, and leaving a smooth, ungrooved field.

It seems unimportant, with such carefully exposed field, whether Ballenger's swivel knife, or Brünig's forceps, or other means be used for removing triangular cartilage, perpendicular plate of the ethmoid and upper part of the vomer. Many authors have urged the rocking or bending of the septum. The adjacent portions of the vomer or ridge swing thus into place, if there be not too much redundancy of tissue. The small chisel for the anterior portion, and Brünig's forceps for the posterior will adequately lift out difficult portions, and it is important in the alignment of the septum, though perhaps not absolutely necessary, that the complete anterior projecting end should be removed, and particularly the deflected hook or exostosis posteriorly. Operatively, this procedure leaves a clean and comparatively uninjured operative field.

For the successful reconstruction of the septum, other points must be noted. The parts must be perfectly adjusted to secure primary coaptation and to prevent serous infiltration and hematoma. Angular incisions leave an extra granulating surface and a difficulty in the proximation of the folds. To prevent serous or hemorrhagic infiltration, a posterior point of drainage, as suggested by Butt and others, may advisably be made, well back between the folds of periosteum, as it can do no harm and stops a distressing complication with possible subsequent infection. The blood-vessels and delicate structures of the mucous membrane are then left in practically normal condition. The delay in secondary anastomoses is avoided if a minimum traumatism occurs.

Iglauer¹³ suggests transplanting various substances to replace lost septal tissue, perforations, etc.—fat, skin, cartilage, bone, and other substances were investigated. This is not successful, hence, the importance of avoiding a gap and thus the necessity of replacing tissue, by leaving at least one perfect lateral surface of subsequent repair.

13. Iglauer: Tr. Proc. A. L. R. and O., 1913.

The operative sequelae of positive and negative type are nearly equal in number. The subjective relief of the patient, first, from his nasal stuffiness and associated irritation, and second the freedom from locked-up degenerated secretion are perhaps most consequential.

Alleviation of eye-strain and headache, relief of accompanying eustachian catarrh, and comfort to the nasopharynx from a remodeled air-current, are complements of the foregoing. The sinuses drain more freely and normally, their capacity as resonating chambers is improved, and slight colds do not irritate as before.

The work on the septum is capable of such careful analysis that accidents can in most cases be directly traced to faulty technic, which occurs here as in other forms of surgical interference.

Squamous epithelium replaces normal columnar epithelium in event of open cartilaginous granulation and gives rise to the constant irritating crusting, even without perforation. Perfect coaptation of the wound frequently leaves a scar which is almost invisible.

The surface of the mucous membrane again becomes abnormally thickened and perhaps permanently hypertrophied from the undue traumatic pressure of excessive or unguarded splints. Whether the bismuth paste of Beck, the cargile or other membrane-covered splints of others, or simple bismuth strips of gauze (demonstrated to me by Fisher) are used, the result is perhaps nearly equal, if undue pressure be avoided. One cannot accept the belief that a degenerated slough, even though protective, can fail to produce deterioration to mucous membrane when present. I have not found it advisable to leave the cavity without splints, but I have obtained excellent results by covering them with thin rubber tissue, which facilitates removal and seldom leaves excoriation.

Packard¹⁴ has reviewed the accidents and complications following operative procedures, quoting Ler-

14. Packard: Diseases of the Nose and Throat.

moyez' classification as those of infectious, nervous and mechanical origin and in the nervous group widespread disturbance from simple neuralgias, vertigo, etc., even to asthma, laryngeal spasm and exophthalmic goiter.

It seems to have been the experience of those who have done considerable submucous work that it is best to adopt this procedure in practically every septal case. It is logical to assume that the preservation of a normal membrane is infinitely preferable to replacement of other tissue, and that a normal membrane with the slightest opening presents the smallest avenue for entrance of infection.

The most important point in diagnosis is to determine what is functional and what organic septal abnormality and, having determined the organic deviation, to form correct judgment as to the sequence of physiologic events in surrounding nasal and post-nasal chambers.

Careful determination should be made as to the integrity of the mucous membrane, and if one side of the septum be sclerotic and thinned from previous erosion, as to whether the opposite membrane has sufficient vitality to form a safe retaining wall after operation.

After the suggestion of Roe,¹⁵ the character of the external nose must be considered under these conditions: the firmness, the tip of the anterior nares, the degree of droop in the lateral folds, the type of fullness or aquilinity in external appearance, and the relation of the deflecting bulge to the outlets of the accessory sinuses.

Secondary injury to sinus or eustachian tube is usually due to locking infective secretions behind the deviation. I would make an especial plea for one particular procedure—beyond simple salt solution, antiseptics should be avoided in the nose at or near the operative period. In the Children's Hospital, it has been the custom to leave tonsils without interference after the

15. Roe: Med. Rec., New York, 1905.

operation, and the results have been uniformly as favorable as with other methods. The nasal secretion is naturally protective, and I deprecate the destruction of such secretion by either excessive washing or application of any active chemical solution whatever.

No traumatism, no undue pressure, complete removal of offending deviating structure, and avoidance of destruction of the natural resistance of the nose thus would seem to be the cardinal features in reconstructing a normal nose.

Believing that findings of any positive value should be recorded in contemporary literature for the sake of mutual benefit, I selected the topic of this paper in part as a vehicle to present the following rather interesting opportunity for study.

This particular patient presented himself about a year ago suffering from hay-fever neurosis of marked degree; examination of the posterior nasal cavity revealed too close propinquity of the septum and the lower portion of the middle turbinate. Submucous resection was advised and arranged for the following September and rather fortunately assistance was rendered by a careful student of septal surgery, Dr. Butt.

In separating the perichondrium posteriorly, a peculiar leathery resistance was found—a feeling resembling that of pressing on chamois-skin. This tissue doubled up somewhat but was fully and successfully separated, and a large segment of the cartilaginous septum removed. Comment was made by those engaged in the operation on the unusual folded feeling, but no other great difficulty was experienced even over the cartilaginous borders, and the inner surface of the perichondrium did not seem abnormal. The patient gave a history of having undergone a nasal operation by a specialist in western New York about two years previously, but he was somewhat doubtful about its nature.

Figures 4 and 5 show a reproduction, first, of the septum containing the segment from the posterior

smooth end of which the section was taken, and second, a reproduction of a slide showing fibrous tissue interspersed with vascular spaces, a certain amount of granular tissue and a well-formed nest of young growing cartilage-cells.

The specimen, as portrayed in Figure 4, showed a smaller fibrous arc of reformed septum within the larger segment, forcing the conclusion that a successful submucous operation, though an insufficient one, had been done previously. The posterior hook-like end of the vomer also continued to cause disturbance. This specimen placed in weak formaldehyd solution and later in alcohol hardened into firm septum, and, on cross-section, as in Figure 5, revealed a well-formed nest of cartilage-cells, some evidence of reforming blood-vessels and a very firm union of the fibrous tissue and the adjacent portions of the cartilage.

Several points of interest arose from this demonstration: First, it was possible a second time to lift the perichondrium, probably a silent testimonial to the skill of the previous worker, and it was possible even to remove this adequately from the junction lines of the repaired and permanent septum. Second, the circulation in and around the septum seems to have been quite adequately restored, and the mucous membrane did not indicate the fact of a previous submucous operation. Third, the body of the repaired tissue was a dense fibrous stroma with occasional interspaces, perhaps circulatory, and containing this nest of growing cartilage-cells. Fourth, the consistency and strength of the septum seemed thoroughly adequate under all manipulative measures prior to the operation.

The question arises as to the reformation of cartilage growth. After careful examination and discussion with various physicians, I have come to believe that the cartilage is probably due to accidental growth and possibly a portion of cartilage left, though showing no bulging. The picture, however, presented both

intranasally and subperichondrially and even after removal was that of a perfectly restored septum, somewhat thinner and more pliable than the original. My conclusion is in conformity with evidence repeatedly indicated, that cartilage itself does not reform. The weight of evidence in favor of the reassumption of anatomic and physiologic integrity is, however, most satisfactory.

CONCLUSIONS

1. A submucous resection, properly and completely done, will reconstruct a perfect, functional septum.
2. If a careful superior margin be left, even with scant anterior and posterior sthenic removal, the alignment in the nose externally and internally will be satisfactory and adequate.
3. If the bulging extremities of the nasal tubercles, ridge, and vomer, when obstructing the nares, are not relieved, the result of the operation is unsatisfactory to the patient.
4. The removal of posterior pressure is more important than a harmonious anterior picture, and unequal space in front does not necessarily disturb respiratory and drainage functions.
5. Fresh anastomoses will restore obliterated vessels to the extent of presenting a normal vascular septum if traumatism has not been unreasonable.
6. Areas in which mucous tissues are lost and replaced by squamous epithelium will probably crust, allow occasional intermittent hemorrhage and irritate the nose.
7. Perforations may be avoided if at least one firm side of mucous membrane is allowed to remain intact.
8. In soft, collapsible roof and sides a greater margin of cartilaginous and bony ring should be left to support the flexible nose and prevent drooping.
9. Drainage and perforation posteriorly will not injure the nose and will prevent exudate and hematoma of the septum.

10. Pressure of pads and splints should be avoided by protection of their surfaces and adequate judgment as to amount easily tolerated.
11. Reflex and other symptoms associated with the indication for operation will gradually and completely disappear in a large percentage of cases.
12. Submucous removal is the method of preference for all septal procedures, and when carefully and completely performed may afford immeasurable relief.
13. The natural secretion of the nose will prove sufficient for postoperative antisepsis.
14. The new fibrous replaced septum bears approximately the same relation to the perichondrium and periosteum as before.
15. There is no evidence that the softer reorganized septum carries any functional disadvantage, even in its vasomotor relations.

1901 Chestnut Street.

THE RELATION OF PATHOLOGIC CONDITIONS IN THE NOSE AND THROAT TO THE ORIGIN AND TREATMENT OF HYPERTHYROIDISM

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The thyroid gland prepares an internal secretion which is not limited in its action to a single mechanism, as is the case with secretin. There is much evidence to support the belief that it acts on a wide range of tissues. Prominent among the theories of its function is that of detoxication, but the mechanism of its action in this respect is not well understood. The older theories of Notkin and Blum are no longer acceptable. The metabolic activity of the tissues in a thyroidectomized animal is below *par*. There is a lowered oxygen absorption, greater tolerance for carbohydrate, a lower body temperature and a diminished activity of both physical and mental processes. The whole picture is changed by the administration of thyroid extract. Poisonous substances which might seriously affect an animal in the abnormal condition following thyroidectomy may not be so dangerous to a normal animal or to one receiving thyroid extract; not because of a direct antagonism or neutralization of the toxin by thyroid secretion, but rather because the inactive tissues of the thyroidectomized animal are less able to protect themselves.

The experiments of Perrin and Jeandelize show that a thyroidectomized animal is more susceptible to bichloride poisoning than normal animals. Frugoni and Grixoni assert that animals with experimental tuberculosis are favorably influenced by continued

administration of thyroid extract. These results are to some degree confirmed by the experiments of Marb , who found that the phagocytic function of the leukocytes and the opsonic index of the blood are distinctly lowered by thyroid removal and stimulated by thyroid administration. Numerous clinical reports show the common belief in the diminished resistance of hypothyroid subjects to the common infections, and beneficial action of thyroid administration in such cases. Sajous has advanced the hypothesis that the mechanism of the defense against infections depends to a large degree on thyroid function.

The most complete experiments showing the anti-toxic value of thyroid feeding are those of Hunt, who has found that white mice are protected from acetonitril poisoning by thyroid administration and that there is a close quantitative relationship between the amount of thyroid given and the amount of poison to which it affords protection. The protection to toxic substances evidenced by these experiments is not a universal phenomenon, however, for other animals such as rats and guinea-pigs are rendered more susceptible to acetonitril by thyroid administration, and mice which are protected to acetonitril poisoning are rendered more susceptible to morphin. Such observations indicate a marked alteration in the metabolic processes of the animal rather than a mechanism of protection.

The relation of thyroid disease to previous infections has been noted clinically by many observers. In this connection it is well to remember that thyroid disturbances occur most frequently in persons of a thymicolumphatic constitution, and it is these individuals who are most susceptible to infections. The terminal event in hyperthyroid patients is not infrequently an infection which has begun in the tonsil, and I have not seen a necropsy in these instances which did not disclose the characteristic pathology of *status lymphaticus*. Its most common occurrence in women

and its relation to the functions of the sex-glands, such as puberty, menstruation, pregnancy and lactation, are worthy of note.

A large percentage of patients with exophthalmic goiter have enlarged tonsils and adenoids. They give a history of repeated attacks of acute tonsillitis. Not infrequently one or more of the accessory sinuses are or have been infected. It is not uncommon to date the beginning of the thyroid enlargement from a particularly severe attack of tonsillar infection.

Infections in the nose and throat are undoubtedly the most common to which the human family is subject, and with that fact in mind one so disposed might build an hypothesis relating many of our ills to that forerunner. And such a conclusion would in many instances be justified for the tonsil is one of the most important ports of entry we have for infections; but in this case the resultant condition is a hyperactivity of a gland of internal secretion and not a continued infection. It is obviously more difficult to explain such a result than to trace the connection between an acute tonsillitis and a septicemia or an infected joint. An observation of much interest in this connection has been made by Halsted. In 1888 he removed a large part of the thyroid gland from normal dogs and found that the portion remaining became hyperplastic. These experiments have been widely accepted and quoted to prove a capacity for compensatory thyroid hypertrophy, but twenty-five years later, in 1913, he repeated the experiments and found that he could no longer get the same results. In the first experiments the animals' wounds were invariably infected, while in 1913 he employed careful aseptic methods and obtained primary union. Halsted does not draw the conclusion that the wound infection causes the hyperplasia, but he recognizes that such may be the case. The relation between infection and thyroid hyperplasia has further support in the experiments of de Quervain, who found that the injection of bacterial

toxins caused a marked hyperplasia similar to that produced by Bircher in rats by giving them water from goitrous wells.

The theory of the origin of thyroid hyperplasia from a specific infection has been recently reviewed and developed by Gaylord in his report on carcinoma of the thyroid in salinoid fishes. In the course of this work he studied the effects on the thyroid of rats and dogs produced by mixing with their food sediment obtained from the ponds inhabited by the goitrous fish. Such a diet produced quite remarkable thyroid hyperplasia in some of these animals; more striking, in fact, than that produced by McCarrison, who produced thyroid enlargement in goats by giving them water contaminated with the feces of goitrous men.

Infection does not in a large percentage of cases produce such an enlargement of the thyroid gland that it would be recognized as a goiter, and it may be that the thyroid does not react in this manner except in those who are not quite normal in respect to the balance of their glands of internal secretion. If the thyroid secretion is an important element in the defense against infections, it is not impossible that it is stimulated to overactivity when occasion demands, and if the stimulus be often repeated it may produce changes which we recognize as pathologic. Through the repeated stimulus to over-activity, the gland has become hypertrophied, and its heightened function continues long beyond the stimulus which called it forth. Certain experiments which I have published show beyond reasonable doubt that the discharge of iodin from the thyroid is to some degree under nerve control, but this fact does not argue against other influences working to the same end. The gastric secretion is under two influences, one nervous and the other chemical, and it is by no means unusual to find patients with a hyperactivity of the glands secreting the hydrochloric acid of the gastric juice.

Clinically there is an important relation between the infections in the nose and throat and hyperthyroidism. In patients between the ages of 16 and 24, from 35 to 40 per cent. give a history of repeated attacks of acute tonsillitis, and many of them have a chronic pharyngitis and rhinitis with enlarged tonsils and adenoids. Not infrequently one or more of the accessory sinuses is infected. It is by no means a rare thing to find that a rapid enlargement of the thyroid with characteristic symptoms of overactivity has followed immediately after a particularly severe tonsillar infection. Such patients bear these infections badly. Their convalescence is slow and each attack is accompanied by severe prostrations quite out of proportion to the seeming severity of the infection. It has been my observation that the leukocytosis accompanying these infections is lower than usually found in similar conditions in non-goitrous patients, and, although they may have the local condition characteristic of quinsy, they do not usually form an abscess which gives free pus when opened. Hyperthyroid patients often show a marked leukopenia with a relative lymphocytosis indicating some influence on the blood-picture, and this influence is evidently operative when the organism is subjected to infection.

There is no complicating factor in exophthalmic goiter which is more troublesome or more dangerous to the patient than the tonsil infections to which they are subject. Every effort should be made to prevent them. When the patient's general condition will permit, the tonsils should be enucleated and the adenoids removed. But such an operation should not be done on a patient suffering from an active thyroid intoxication without appreciation that such patients do not stand operation of any sort well, and all precaution should be taken to prevent shock from the ordeal. The methods followed by Crile in stealing the thyroid apply quite as forcibly to operative procedure of every sort on these patients. It has not infrequently

happened that the surgeon has been surprised by the unusual reaction following tonsillectomy and has found on closer examination that his patient had an enlarged thyroid with most of the symptoms of hyperthyroidism. Such an observation should precede and not follow the operation. The relief which follows the elimination of infection, whether in the sinuses, the nasopharynx or tonsil, is usually so prompt and effective that one has little doubt as to its causal relation to the overactive thyroid, and it becomes at times more important to attend to the infected areas than to attempt direct action on the thyroid. By so doing many patients will be permitted to retain their glands for a useful function.

Every young patient with an enlarged thyroid should have a careful examination of the nose and throat, and the converse is equally true. Between the ages of 12 and 20 is the beginning point of most thyroid enlargements, and it has been my observation that a combination of enlarged chronically infected tonsils and adenoids, gastro-intestinal disorders accompanied by constipation, and an enlarged thyroid with mild nervous and heart symptoms is the beginning of a condition which usually does not attract much attention unless the patient (and these individuals are nearly always young women) is annoyed by the cosmetic defect in the neck. This is the physical foundation to which such girls bring the exacting demands of school, college and social life, and under its strain a large percentage of them sooner or later fall as victims. Hyperthyroidism can be checked in such patients before any serious damage is done if the beginning is recognized. It is unfortunate that the facility with which the thyroid gland can be removed has led to many needless operations in the type of patient described.

The beginning of thyroid disease should receive more attention. Too frequently it is overlooked, and when discovered is taken lightly except in the face

of quite disturbing symptoms. The progress of preventive medicine will ultimately lead to the discovery of most of these beginning cases at a time when they are easily curable with preservation of the integrity of the thyroid. Medical inspection in school and college should accomplish a great deal more in this respect than it now does.

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ABSTRACT OF DISCUSSION

DR. CHARLES G. JENNINGS, Detroit: One word concerning the question of diagnosis; what symptoms will put the examiner on the track of thyroid toxemia? So far as my experience goes, there are two symptoms of the greatest value, which are easily elicited by the usual examination. They are the debility and the tremor. Both may be mild but are almost uniformly present. The question of therapeutics is largely hygienic. Rest is perhaps the most important. Girls in early adolescence, in boarding schools particularly, suffer from a mild type of the trouble and they must be given rest; social, intellectual and physical rest. The wear and tear of social functions often bring about this condition. As to medicinal treatment, my experience is that in these cases, in spite of the fact that they are cases of hyperthyroidism, the patients do well on a thyroid preparation, administered over a long period in small doses. I am in the habit of using the preparation produced by Dr. Beebe in the Cornell Laboratory. Many of these cases respond well to this remedy, combined with rest and symptomatic treatment. Occasionally quinin hydrobromid can be alternated with the thyroid preparation. There is nothing special in the diet so far as I can see, except a diet that will relieve digestive embarrassment, if that be present. Occasionally ferrous iodid seems to be valuable. Some recently published observations by Wilson and Plummer of Rochester show that this type we so frequently see is a distinct pathologic and clinical entity. Wilson calls them toxic non-exophthalmic goiter and the changes in the gland as observed by him are not those of true exophthalmic goiter. They do not develop the eye symptoms. Such cases go for ten or fifteen years with symptoms of hyperthyroidism and yet never develop characteristic exophthalmic goiter. The pathologic changes are hyperplasia, regeneration, and the formation of connective tissue, and of course this gives rise to perverted secretion. Many times the thyroid condition is the primary one in the hyperthyroidism of later life. The pathologic conditions of the upper respiratory tract are the results of disturbed nutrition,

coincident with the hyperthyroidism. Many of the symptoms these patients complain of are those of perverted secretion in the throat and fauces. One of the most important facts is that these conditions in the upper respiratory tract cause cough and that the symptoms of hyperthyroidism—the pyrexia which is not unlike that of tuberculosis, tachycardia, cough and acute digestive disturbances—in many cases closely simulate those of tuberculosis, makes it difficult to distinguish hyperthyroidism from tuberculosis. The pathologic condition of the tonsils seems to be closely related to the thyroid trouble. The physiologists ought to be able to help us considerably in this study.

DR. OTTO JOACHIM, New Orleans: Twenty-five years ago Fraenkel called attention in a clinical case to the reduction of goiter on the same side as that on which he reduced a hyperplastic inferior turbinate. This was looked on at that time as a very extraordinary result and not held in any causal relation. The idea was not followed up. We should be very grateful to Dr. Beebe for calling our attention more specifically to the pathologic condition following infections of the nose and throat. More strongly than ever, the theory of disturbed internal secretions advanced yesterday by Dr. Beck appeals to me. We need not look necessarily for a focus of a purulent type to explain these disturbances. A great many will be accounted for on the ground of disturbed defective or overactive internal secretions which in turn affect the thyroid.

In our part of the country we see a great deal of thyroid trouble, especially in young people, and we are often confronted with the necessity of relieving these patients without operation. I am also of the opinion that, in the earlier stages, these cases are amenable to therapeutic measures. Operation is not always indicated and the diagnosis of the beginning of the trouble is of extreme importance. The importance of these relations between abnormal conditions of the nose and throat and hyperthyroidism, however, are such that we need thorough laboratory investigations to clear up the matter. Of course as laryngologists, we are not necessarily competent and have not always the opportunity to properly study these cases. They come to us and then disappear from our observation. The final light must come from the internist who has a better opportunity for this study.

DR. GEORGE E. SHAMBAUGH, Chicago: Dr. Beebe brings out the importance of the specialist cooperating with the internist. I emphasize this because there has been too great a tendency toward the development of special hospitals, where the eye, ear, nose and throat specialist does his work isolated from close association with other fields of medicine. The few advantages in this arrangement are far outweighed by the much greater disadvantages arising through the lack

of cooperation with other branches of medicine. The best arrangement, and the one in which our best work is done, is in a general hospital, where our work is carried out in cooperation with the internist, the neurologist, the general surgeon, the dentist, etc. In the Presbyterian Hospital, in Chicago, we have been interested in this relation between hyperthyroidism and the faecal tonsils. I have several times been requested by the internist to remove the tonsil in these cases, and when asked to operate in such cases, I do so, nor do I attempt to hunt over the tonsil for palpable evidence of foci of infection before consenting to carry out the internist's request. The possibility of abnormal tonsils being the focus for the changes in the thyroid is interesting. I have several times seen the disappearance of the hyperthyroidism in a remarkably short time after the removal of the faecal tonsils. It has been suggested that the relation may be reversed. If so I do not see why the goiter should disappear after the removal of the tonsils.

DR. JOHN F. BARNHILL, Indianapolis: This subject is entirely too new to have data that is worth while. It is only in the past two years that we have been adding to our case records, or at least that I have, the condition of each thyroid at the time of making the throat examination. Dr. Shurly recently, before the American Laryngological Society, expressed the belief that there is a relationship between hyperthyroidism, and tonsil and throat infections. Knowing that we were to have Dr. Beebe's paper, on my return home from this meeting of the Laryngological Society I looked up as many of the cases of hyperthyroidism in which I had operated for removal of the tonsils, as I could find. I found seven cases in which in the last three years I had removed the tonsils when this condition existed. In none of these cases, so far as I was able to judge, was the thyroid condition improved. One of these patients had been operated on in one of the large clinics for hyperthyroidism two years previously. The surgeon who did the operation had stated that the patient had enlarged tonsils which ought to be removed at once. When she had fully recovered from the thyroid operation I removed the tonsils. She was improved for a time. I saw this patient three days ago and the lobe of the thyroid opposite to the one which had been removed is now enlarged and she has very marked exophthalmos. This was interesting to me because one lobe of the thyroid had been removed and the tonsils had been removed, and yet she still has the condition of hyperthyroidism. I believe that there is a connection between tonsillar infection and hyperthyroidism in the same way, perhaps, as an infected toe or antrum or gall-bladder might bring about such conditions; that is, by lowering bodily resistance. It is our duty, therefore, to discover these cases early, because I am convinced from exam-

ination of the cases that I have recently made, that whatever benefit we are to get from removal of the tonsils must come from operating in an early stage of the thyroid enlargement.

DR. JOSEPH C. BECK, Chicago: The subject of the infections of the upper respiratory tract in connection with thyroid disease has interested me for some time and I am in a position to speak from experience on the subject in its entirety, for I follow these cases whenever hyperthyroidism is present. Dr. Barnhill said exactly what I would say with reference to the curing of any patient with hyperthyroidism by removal of the tonsils and I have had quite an experience in that line. I have seldom seen a case that did not respond by improvement, nor have I seen a single case that was difficult to operate on. One certainly would not attempt to do a tonsillectomy in a patient in a down-grade stage of hyperthyroidism. Tonsillectomy will do this; it will do what a single ligation of the superior thyroid artery will do; it is transitory. It puts the patient in a condition in which a thyroidectomy may be done. My statement concerning the tonsils as causing hyperthyroidism is based on a study of the sympathetic nervous system. It is believed that toxic elements, not necessarily pyogenic, either stimulate or depress the vagus and alternately the sympathetic and produce changes in the internal secretions. The pathologic changes in the thyroid itself, of course, we understand, the colloid changes, which are degenerative, and have nothing to do with an infective process.

DR. GEORGE F. CORR, Buffalo: My experience has been similar to that of Drs. Beck and Barnhill. I have operated on children of 10, 15 and 20 years of age and people as old as 69, and not a single one of these patients, thirty in number, have had any throat complaint or tonsillar or sinus trouble. So that I have reason to believe that the condition was not due to any infection of the upper respiratory tract. Dr. Beck told us what we may expect from disturbances of the internal secretions and, of course, these infections may cause disturbance of the internal secretions, but that may happen in other diseases as well as in goiter. Of all the patients I have operated on for goiter, not one complained of trouble with the throat or nose at any time. I want to make this statement from the point of view of a laryngologist as compared with that of Drs. Beebe and Jennings, and I think we have as much chance of observing these conditions as has the internist.

DR. OWEN P. SMITH, Portland, Maine: For fifteen years I have been interested in this particular line of work. The question of diagnosis in these cases is particularly important to the laryngologist because a great many of them come to him before the symptoms become so pronounced as to attract

the attention of the internist. In small cities the laryngologists are supposed to be better qualified to handle these cases than a great many of the so-called general practitioners, and they should not only be able to cooperate with the internist, but should be qualified to handle these cases both from a medical and surgical point of view.

A discouraging feature, from my observation, is that it is difficult to decide from the work of the internist and the surgeon just what is best to do in these cases; whether to treat them medically or to go on to the more radical surgical procedures. The medical treatment, in my experience, has been rather disappointing. I have followed, more or less, the work of Dr. Beebe and Dr. Forscheimer. The latter basing his work, perhaps, on the septic theory, has attained better results than in any other method of medical treatment. On the other hand, the radical surgical treatment at times is very disappointing, although sometimes the results are striking, the patient recovering rapidly.

DR. HENRY HORN, San Francisco: The propaganda of education which Dr. Beebe has presented is at this time very apropos. We, as laryngologists, possess a field of investigation which up to this time, so far as I know, has not been worked up, and inasmuch as the object of these meetings is to draw the general surgeon, the laryngologist and the internist into closer contact with our work, I desire to call attention to a problem which perhaps has not been sufficiently considered: the possibility of the tonsil as an organ of internal secretion. As specialists who remove hundreds of tonsils, we are possibly in a position to draw conclusions better than any one else, but, nevertheless, in the thousands that are removed, the opportunities for observation are seldom carried out in any systematic way. I only wish to call attention to the fact that there is a certain class of cases, especially in young women, in which removal of the tonsils will produce a condition closely related to what we know as the thyroid symptom-complex; tachycardia, intense nervousness, etc. Now, of course, that suggestion is immediately open to the objection that these cases may be cases of hyperthyroidism; I do not think so, and I think we should observe some of these cases and study them more closely with the internist.

DR. BURT R. SHURLY, Detroit: I have been much interested in this subject for five or ten years and I think there are certain points that we are very liable to neglect. Certain essential facts are necessary to be known, for in the equipment of the laryngologist certain facts of diagnosis in internal medicine are particularly valuable to us, if we can have classified knowledge and definite ideas of just exactly how we are to consider some of these problems that really belong to internal medicine and yet in which we have a great

interest. In this way our equipment as laryngologists will certainly be very much improved. The great essential, it seems to me, is that we should consider an examination of the thyroid gland as part of our routine procedure in every case. A great many men will overlook the thyroid gland entirely, while if we will examine it anything of particular significance may be immediately followed up with further investigation. Dr. Beebe and Dr. Rogers of New York have certainly been the pioneers in developing this subject, and they have given us the greater part of our knowledge in this regard. Dr. Rogers has a fine history scheme which immediately concentrates one's investigation of the symptoms of thyroid trouble as it may be connected with any condition of the throat or nose. It is not claimed that diseased tonsils are the only cause of goiter. We all know that hyperthyroidism is very frequently associated with nervous shock, overwork, miscarriages and postobstetric conditions. As Dr. Jennings has said, in Michigan we have a considerable number of mild cases, and many of these are overlooked. It seems to me the prophylactic effect of removing the tonsils is quite effective. If you can prevent recurrent tonsillitis you prevent the acute condition again and it is the acute condition that makes the trouble.

Will Dr. Jennings say something of the essentials of medical treatment?

DR. S. P. BEEBE, New York: It was not my purpose to advocate the removal of tonsils and adenoids as a cure for exophthalmic goiter. If any one has so understood my statement, I wish to correct it. What I have said about the frequent occurrence of infected areas in the nose and throat is derived from the history of approximately 3,500 patients who have had this disease. It is quite possible for one to have had a number of patients with thyroid disease who have not at the same time had either sinus or throat infections. Nevertheless such infections are a most common accompaniment of thyroid disease, and, in my judgment, constitute an important factor in maintaining a condition which favors overactivity of the thyroid gland. One cannot see the effect of repeated infections in these patients without being impressed with their importance. I wish, however, to impress the importance of making every effort to discover the beginning of thyroid disease. As specialists you will frequently be consulted by parents who bring their children to you for nose and throat infections. The patient may not have been seen by an internist at any time and, unless the physician who does see them examines the patient with reference to his general condition, as well as to determine the condition of the nose and throat, many diagnoses that might be made will be missed. Routine examinations of the nose and throat should include an examination for any possible enlargement of the

thyroid gland. Simple tonsillectomy or removal of adenoids is not all that it is necessary to do in the line of treatment even in these early cases, but the custom of regarding a thyroid enlargement as of little medical importance unless accompanied by marked or severe symptoms is an error too commonly made at present. When the thyroid disease is well developed and the gland itself has undergone a marked pathologic change, there is no reason to suppose that a cure will be obtained simply by attention to the nose and throat infections. A recurrence of thyroid disease after repairing the nose and throat does not controvert the necessity for attention to such a condition. The most important thing in this work is to prevent the serious thyroid disease which has insidious beginnings, and these patients so often come to the nose and throat specialists first that it is of decided importance that the beginnings of thyroid disease should not be overlooked at a time when the patient's recovery is a comparatively simple matter.

HEMORRHAGE FROM THE SUPERIOR PETROSAL SINUS

AS A COMPLICATION IN OPERATIONS ON THE LATERAL
SINUS

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Hemorrhage from the superior petrosal sinus exists as a possibility in operations on the lateral sinus despite the fact that, with one exception, no mention is made of it in any of the literature published on mastoid or lateral sinus operations. Since attention has now been called to it there is little to add except to show briefly how the complication occurs, and how its results are frequently unfavorable to the patient.

The superior petrosal sinus is described in the various textbooks on anatomy as being one of the terminal divisions of the cavernous sinus, running in a small groove in the superior border of the petrous portion of the temporal bone in the attached margin of the tentorium cerebelli and terminating in the lateral sinus at the point where the sigmoid portion of that vessel begins.

While this termination is usually described as being through a single opening in the wall at the knee of the lateral sinus, this frequently is not the case. The petrosal is often found to empty itself through a series of openings 3 or 4 mm. apart, extending along the sinus wall at a distance of 2 or more cm. Knowledge of this fact is obviously of surgical importance in the control of hemorrhage from these openings after the lateral sinus has been incised.

It was not until some years after Richards had called attention to the faulty technic that was being generally followed in operations for sinus thrombosis

that the importance of accurate inspection of the interior of the sinus was generally accepted. The latest authorities, however, now agree on the importance of getting a distinct view of the interior of the vein, and of removing the infected walls as well as the thrombus. Kerrison emphatically expresses this view in his book, recently published, when he says:

'The aim is to expose the interior of the vessel to actual inspection. To attempt less but adds to the patient's risks and supplies the surgeon with absolutely no data of diagnostic value.

In his description of the technic required to accomplish this, however, he implies that beyond possibly an emissary vein the sources of hemorrhage to be considered are solely the two extremities of the sinus itself. The other well-known text-books and articles on the subject give practically the same impression.

Except in Dr. Richards' article on operative treatment of sigmoid sinus thrombosis,¹ a review of literature relative to operations for thrombosis of the lateral sinus reveals comparatively few references to the superior petrosal sinus, and none at all to hemorrhage from that vessel as a possible complication to be encountered during the operation; so it would seem that the occurrence is not frequent. This view is strengthened by the experience of the majority of the surgeons whom I have consulted on the subject. Few of them recall cases in which the hemorrhage was definitely found to arise from the superior petrosal sinus, and yet not infrequently when a sinus is opened for relief of a suspected thrombus, hemorrhage is encountered despite the attempt at control exerted above and below the point of incision.

That the complication does not more frequently arise is due to the fact that the field of operation in the majority of cases is limited to the vertical limb of the sigmoid, and the posterior point of compression for

1. Richards: Arch. Otol., 1905.

the control of hemorrhage is anterior to, or just over the entrance of, the superior petrosal sinus. In more extensive cases of moderate duration the thrombus will frequently be found to extend into the superior petrosal, in which case there is, of course, no hemorrhage from that vessel.

Richards speaks of having opened the superior petrosal sinus almost throughout its whole length in a case of extensive thrombosis which had extended to it from the lateral sinus. While I have seen thrombi removed from the lateral sinus well past the openings of the superior petrosal without hemorrhage occurring from it, I have not seen the operation carried to that vessel in order to obtain from it free bleeding, although theoretically that might be the course to pursue.

The cases in which embarrassing hemorrhage from the superior petrosal are likely to occur are those in which the thrombus in the sigmoid extends to the region of its entrance but does not enter it. Injury to the sinus or to an emissary vein in the region of its knee during a mastoid operation will sometimes give rise to a rapidly formed septic clot which does not block the petrosal. In such cases, the pressure plug for control of hemorrhage from the torcular end of the sinus is placed behind the entrance of the superior petrosal, and if this is not blocked by clot, bleeding from it will obscure the field of operation and interfere with proper inspection of the interior of the vein.

Unless the source of this hemorrhage is recognized and the bleeding stopped, the operation is botched, and its purpose to ascertain definitely the state of things within the sinus is defeated. The operator relies on his assistant to control the hemorrhage from above and below the line of his incision with pressure pads placed on the wall of the vein. In such cases, the assistant whose office it is to block both ends of the sinus, seeing the free escape of blood despite his efforts at compression, may temporarily overlook the position of his compresses in relation to the opening

of the petrosal, and exert too great pressure on the cerebellum in his vain attempt to control the hemorrhage. The operator, at the same time intent on observing the interior of the vein, is harassed by the flow of blood over the field, and he too may, in the confusion, overlook the source of hemorrhage.

The result is that more blood is lost than is good for the patient, the wound has to be packed to control the bleeding, and the patient is returned to bed with the source of his infection still present, and his resistance lowered by the loss of blood. This occurrence is exceptional, as has been stated; nevertheless it is sufficiently frequent to warrant some thought of it as a possibility in operations for sinus thrombosis. That it has received no mention in literature may be because it has been considered plainly obvious by the authors; but like other simple facts that are too infrequently met to be well remembered, it escapes attention until personal experience impresses on one the importance of its early recognition. Even personal experience with this complication does not invariably teach, for I have seen it occur to an operator's great confusion and yet remain to the end entirely unrecognized by him; otherwise he might easily have prevented it.

The tendency to blame the assistant for any escape of blood that occurs after the sinus has been opened, regardless of the position of pressure pads, is not uncommon. The relation of the distal compress to the opening of the superior petrosal must, of course, be considered, and I think that we have all seen undue pressure exerted on the sinus behind its knee without effect on the hemorrhage, but with what appeared to be marked traumatism to the cerebellum.

In the removal of cells from the angle of bone that lies between the knee of the sinus and the dura of the middle fossa, hemorrhage from the superior petrosal is occasionally seen. I know of three cases in which the vein was injured in this location without untoward result; two occurred during operations on very pneu-

matic mastoids, and one during a labyrinth operation. Here the injury is of little consequence, as the source of hemorrhage is easily seen and easily controlled; but in operations on the lateral sinus, unless the source of hemorrhage is recognized promptly as being from the superior petrosal sinus, when that vessel is the one involved, the delay in stopping it, and its interference with the object of the operation to remove the infected focus, jeopardize materially the patient's chance of recovery. For this reason, and from the fact that I have found no reference to this subject in literature, I have taken the liberty of calling attention to it.

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THE TREATMENT OF ADVANCED
TYMPANIC DEAFNESS
CLINICAL OBSERVATIONS BEARING ON THE PROBLEMS
INVOLVED

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The title of this paper is clearly open to criticism. Deafness is a symptom and not a disease. To the patient, however, the symptom is the disease, and our treatment is of value to him only in proportion to its influence on audition. Applying the same test, are we as aurists satisfied with our results? Taking as a standard the treatment as outlined in text-books and as practiced in most aural clinics, can we claim as the net result the actual relief of a reasonably large percentage of cases?

While this paper is concerned chiefly with one type of deafness—that is, the deafness of ossicular rigidity—it may not be amiss to mention briefly some of the commoner forms of deafness from other conditions:

1. Deafness due primarily to a lesion of the labyrinth or auditory nerve. Such lesions are fortunately rare as compared with those of tympanic origin. They are not amenable to local treatment.
2. Deafness due to otosclerosis. Whether this lesion is confined to the bony capsule or invades the membranous cochlea, the deafness is not influenced by local treatment.
3. Impairment of hearing due to obstructive lesions of the eustachian tube. Functionally these cases are characterized by moderate impairment of hearing, changing noticeably with external conditions (weather,

etc.) ; and responding favorably and more or less permanently to effective treatment of the nasopharyngeal and tubal lesions.

4. Impairment of hearing due to chronic hypertrophic otitis media. In this lesion the mucous membrane lining the entire tubotympanic tract is thickened and congested. Hearing is improved by rational treatment of the eustachian tubes, but rarely, if ever, regains the normal standard.

I shall not attempt, however, to discuss the types of deafness above defined. They are mentioned chiefly to bring into clearer relief the type of which I wish to speak, namely, the obstinate form of deafness associated with intratympanic fixation of the ossicles. And since an analysis of cases will show nearly all cases of advanced tympanic deafness to fall under this head, their clinical importance must be obvious.

STAPEDIAL FIXATION

Fixation of the stapes may be primary or secondary ; that is, primary when due to morbid changes which bind the foot-plate or crura of the stapes directly to the margins of the oval window or niche ; or secondary when the stapes, though free within the oval window or niche, is nevertheless immobilized through fixation of the malleus or incus, or both. So far as I have been able to determine, the type of deafness does not vary materially with the particular section of the ossicular chain which is bound within the tympanum, nor with the nature of the mechanical obstacle to free ossicular movement ; that is, provided the net result is to prevent transmission of sound waves to or through the foot-plate of the stapes. On the other hand, evidence is not wanting that deafness due to direct stapedial fixation is less influenced by treatment of any kind than is the deafness of same grade and type resulting from checks on ossicular mobility not centered in the fenestro-stapedial joint.

The most characteristic and, so far as local treatment is concerned, the most hopeless type of direct fixation of the stapes is that which occurs in otosclerosis. As the characteristic functional sign of this condition we have Bezold's well-known syndrome, namely, (1) marked diminution of hearing of the lower tones of musical scale; (2) prolonged hearing by bone conduction, and (3) reversed ratio of hearing by air and bone conduction (reversed, or "negative," Rinné). We now know, however, that exactly the same functional reactions must inevitably result from any lesion confined to the conducting mechanism which seriously interferes, either directly or indirectly, with movements of the stapes.

Excluding suppurative lesions, we may mention the following tympanic conditions which not infrequently lead to ossicular rigidity, or fixation:

1. As a result of prolonged subacute exudative inflammation of the tube and tympanum, the tubotympanic mucosa undergoes marked thickening. According to Politzer, the labyrinthine windows are selective regions in which the hypertrophy, or in some cases actual deposition of new connective tissue, is often particularly marked. Theoretically it is conceivable that this process in the region of the oval window may reach a stage causing great reduction of stapedial mobility, later, under treatment or without it, undergoing recession with partial or complete restoration of hearing. This, I am convinced, is a process which explains the considerable and permanent gain in hearing which follows rational treatment in some cases.

2. As a result of prolonged tubal catarrh with deflation of the tympanum, permanent contraction of the tensor tympani muscle may react unfavorably on the movements of the stapes by reducing the mobility of the entire ossicular chain.

3. In the course of a chronic or subacute tympanic inflammation of long standing, with occasional acute exacerbations, adhesive bands are formed between

the head and crura of the stapes and the walls of the oval niche; or between the head and crura of the stapes and the long arm of the incus. Similar bands may bind the long arm of the incus to the inner tympanic wall or, occurring in the vault, may bind the head of the malleus and body of the incus to the outer bony wall of the attic. According to Shambaugh,¹ these bands may represent folds of normal mucous membrane which, during acute inflammatory change, becoming adherent, are later converted into fibrous bands, these ultimately undergoing strong and permanent contraction.

I have long believed that the presence of a reversed or "negative Rinne" in any case of deafness should be regarded *per se* as evidence of stapedial fixation. In other words, labyrinth and nerve lesions do not as a rule disturb the relation of air and bone conduction; and tympanic changes which do not seriously obstruct the movements of the stapes, do not cause reversal of the ratio between the bone conduction and air conduction of sound waves.

Let us review briefly the routine treatment for this type of deafness as practiced in most aural clinics. Ordinarily, it would be somewhat as follows: The ears are inflated by catheter, the condition of the tubes being carefully noted. If the auscultatory signs show clearly the existence of a condition of tubal catarrh, local applications of astringent drugs to the pharyngeal mouth of the tube are made use of. If tubal obstruction of more obstinate type is found, the eustachian bougie or sound is employed. When the tubes have been restored to a more normal condition, or in any case after a few weeks of treatment, the hearing is retested. Frequently a moderate improvement of hearing is found. With a view of obtaining further functional gain, the patient is ordered to return at regular intervals—once, twice or three times a week, according to the physician's views—and at each séance, what-

1. Shambaugh: THE JOURNAL A. M. A., Sept. 27, 1913, p. 1206.

ever else is done or omitted, *the ears are inflated by catheter.*

An experience of years with catheter-inflation has convinced me that the frequent routine use of the catheter *as a means of correcting ossicular rigidity* is based on a false conception of the mechanism involved. The theory on which it is used is, of course, obvious, viz., that the act of inflation moves the drum membrane and with it the ossicles, thereby tending to restore their normal mobility. The beginner in otology is often enthusiastic over the distinct functional gain following a first or second inflation, and is at a loss to explain his failure by the same means to obtain continued and progressive improvement of hearing. The explanation of this phenomenon is that the first few inflations in the case of an individual whose ears have not been under recent treatment often do result in the breaking or at least modifying of small intratympanic adhesions, with consequent improvement of sound transmission. If continued as a routine measure the force of the inflations are exerted more and more in the direction of stretching the drum membrane while exerting progressively less influence on the ossicular chain. Used too frequently or too forcibly, and continued over a considerable period of time, the net result is a disturbance of the tone or balance of the conducting mechanism far outweighing the influence of the comparatively small passive movements of the ossicular chain. There is no question that the victim of chronic middle-ear disease may suffer further permanent disturbance of function as a result of excessive or irrational routine catheter inflation.

The first rational indications of treatment having been carried out, there remains in these cases a variable degree of residual deafness which represents the real problem of the disease.

In referring to a few experiments in the direct examination of the ossicular chain through an incision in the drum membrane, I wish to state most emphati-

cally that this procedure is not advocated as a therapeutic measure for the improvement of hearing. The results, either negative or otherwise, are cited solely for the possible light they may throw on the lesions and the resulting deafness.

EXPERIMENTS

CASE 1.—N. W., a boy of 17, first seen in August, 1912, suffered from bilateral deafness for which, during the three years preceding, he had gone from clinic to clinic, the deafness meanwhile becoming progressively worse. When first seen by me, he was so deaf that he found it impossible to obtain work, or at least to retain any position.

Examination.—Both drum membranes were retracted and presented the white, opaque areas usually ascribed to calcareous deposits.

Hearing Tests.—Acoumeter (all metal and somewhat louder than the instrument usually sold), right ear, 3 feet; left ear, 16 inches.

Loud whisper, right, 2 feet, with errors; left, 1 foot with errors.

Lower tone limit, right ear, 60 d.v.; left ear, 128 d.v.

Upper tone limit, slightly lowered in both ears.

Bone conduction, 256 fork, markedly increased in both ears.

Rinné, reversed ratio in both ears.

Weber test, not lateralized.

A noticeable feature in this case was the disproportionate loss of hearing for conversational speech as compared with other functional reactions. On account of this disabling feature of his deafness, I advised him to take up seriously the study of lip reading. This advice was not well received, the patient contending that if nothing could be done to improve his hearing he could not make a living. He was accordingly placed on the usual routine treatment.

In December, 1912, the loud acoumeter² was heard as follows: Right ear, 5 feet; left ear, 2 feet. For all practical purposes, however, his hearing was in no way improved, and the patient was deeply despondent. I therefore told him that I would like to investigate the condition of his ossicles through an incision in his drum membrane, but could do so only with the distinct understanding that such a procedure would be altogether experimental. To this proposition he readily agreed.

2. The acoumeter which I have used in these tests is made entirely of metal, emitting a somewhat louder sound than the usual rubber-encased instrument. In testing the very deaf, such as are referred to in this paper, I have found it convenient to strike the short lever forcibly with my finger, thus eliciting the maximum sound, which again is louder than that produced in the prescribed way. It is in reference to these facts that I have used the term, "loud acoumeter," in this paper.

Surgical Measures.—The instruments, a scalpel-shaped myringotome, blunt hook, and probe with a distal or terminal notch, were especially ordered for this case.

January 8, 1913. The left canal and drumhead were cleaned with alcohol and dried, and a pleget of cotton, dipped in a 10 per cent. solution of phenol (carbolic acid), was placed against the drum membrane and removed after about two minutes. A nick in the posterior segment, just behind and parallel with the hammer handle, caused little pain and little or no bleeding. A cotton pleget saturated with 10 per cent. solution of cocaine was placed in contact with the drum membrane, the head tilted toward the opposite shoulder, and the air in the auditory canal compressed as in the fistula test. Two minutes later, the tympanum was quite anesthetic. The nick in the drum membrane was now extended upward and downward along the posterior margin of the hammer handle. The hook, pointing downward, was next introduced and rotated so as to engage the hammer handle, and slight traction used. So far as any sense of "give" or yielding could be appreciated, the ossicular chain, or at least the malleus, seemed firmly fixed. By gentle traction I could draw the patient's head toward me, and I received the impression that any excessive force would result in fracture of the hammer handle rather than rupture of its ligamentous or fibrous attachments. That no excessive movements of the stapes occurred was shown in this case by absence of nystagmus or of marked disturbance of equilibrium. Several minutes of intermittent traction produced a slight sense of yielding of the hammer handle but no sudden breaking of any adhesion or constricting band that I could appreciate.

Tests immediately after this experiment showed the loud acoumeter to be heard 14 feet, an increase of 12 feet. Hearing for other sound was also increased, the patient himself being sufficiently impressed with the practical nature of the change to request a similar investigation of the right ear. Accordingly, on January 17, the right ear was subjected to the same treatment, with similar results, the hearing distance for the acoumeter being increased from 5 feet to 20 feet.

In the attempt to maintain this result it has been necessary to repeat the manipulation of the ossicles many times in both ears with the following results. In the right ear the hearing distance for acoumeter seems to be stable around 20 feet; in the left ear, it is subject to variations, or relapses, falling at times to 4 feet or less, and going back under treatment to 15 feet. The lower tone limit which was 60 d.v. in the right and 128 d.v. in the left ear, is about 48 d.v. in both ears. In the right ear, which seems to be the least subject to variation, a perforation in the postero-inferior quadrant of the drum membrane seems to be permanent, and this may be a factor

in the functional change. Hearing for conversational speech is still very poor though sufficiently improved to enable him to hold a position whereby he earns support.

This case is certainly not cited as a remarkable restoration of hearing, for the patient still has difficulty in interpreting the human voice; and one cannot be sure that the functional gain, so far maintained, may not later be lost. The point I wish particularly to make is that by this method of examination I was able in this case to demonstrate a degree of rigidity involving apparently the entire ossicular chain, for which the usual treatment by inflation, etc., would be not only useless, but irrational and therefore contraindicated.

CASE 2.—A. S., a girl of 20. Disabling deafness of type characteristic of stapedial fixation, plus physical signs of chronic middle-ear disease. Passive movement of hammer handle by method described in Case 1, showed malleus to be fairly movable. This was followed by a moderate improvement of hearing which, however, was quickly lost, the hearing receding to its previous status. Repetition of this procedure brought the same sequence of events.

Deduction: From the comparatively free mobility of the malleus and its relatively small value in sound transmission, I conclude that this was a case of otosclerosis masked by intercurrent chronic tympanic disease. Passive movement of malleus produced moderate temporary improvement of sound conduction, but in no way influenced the osseous fixation of the foot-plate of the stapes.

The futility of inflation in such a case would seem hardly to require argument.

CASE 3.—This was a typical case of otosclerosis, with Bezold triad syndrome well marked, drum membrane fairly normal in appearance and tubes of normal patency. The deafness was very advanced and the patient had been subjected to much useless treatment.

Passive exercise of the ossicles was tried in this case solely with the purpose of gaining any light which this experiment might throw on such a lesion. As might be expected, it proved practically without influence on audition.

CASE 4.—This case was that of a young woman with extreme deafness. Drum membrane on right side was thin,

transparent and retracted giving an unusually clear picture of the oval niche and incudo-stapedial joint. What appeared to be fibrous bands passing from stapes to wall of oval niche seemed to show graphically the nature of the obstacle to sound transmission. A hospital colleague who examined the case with me, considered it a particularly favorable case in which to attempt the release of the stapes by the breaking up of the constricting bands. This I attempted to accomplish through forcible passive movements of the malleus. The results as measured by any influence on hearing were absolutely *nil*.

This and the preceding case are cited solely in support of the proposition that there are degrees of direct fixation of the stapes, however produced, which are absolutely uninfluenced by even the most direct and forcible movements of the malleus. Under such conditions the futility of inflation and the usual method of local treatment should be generally recognized.

With regard to the cases of purely tympanic deafness—that is, those to which the popular terms “chronic catarrhal” or “chronic adhesive” are applied—it will be safer to generalize. It would be easy to cite a few cases of spectacular but purely temporary improvement of hearing, but such citations might lead to quite erroneous conclusions.

With reference to the varying character of the impediment to sound conduction, the following brief notes of conditions observed may be of interest: In one case of advanced deafness the malleus, which seemed quite rigid, suddenly yielded under gentle traction as from the rupture of some adhesive process. Coincidently with this, the patient stated that all sounds seemed unusually loud and that sounds now came to him which he had not heard for years, e.g., the friction of his shoe on the floor. Hearing distance for the acoumeter was increased from 3 to 15 feet. I naturally hoped that I had obtained an unusual result for this patient. Even before the drum membrane healed, however, there was a recession of hearing power, the entire gain being soon wiped out. On repeating the experiment, I was rather surprised to find the malleus still freely movable. This time, how-

ever, passive movements of the hammer handle did not bring a similar gain.

What occurred in this case I take to have been as follows: My first passive movements broke up simultaneously separate adhesive processes involving the malleus and the incus, or more likely the malleus and the incudo-stapedial joint. Following this, the free mobility of the malleus was maintained, while the adhesive process involving the stapes was quickly reformed; and this after its reestablishment, was no longer influenced by passive movements of the now relatively detached malleus.

In more than one case I have found what seemed a fairly movable malleus, passive movement of which produced an appreciable though comparatively moderate and purely temporary gain in hearing. This condition I interpret as the sign of direct fixation of the stapes within the oval window or niche. This hypothesis, if correct, would support the conclusion that there are grades or types of stapedial fixation which cannot be corrected through movements transmitted through the malleus and incus, and for which inflation would be obviously worse than useless.

In other cases in which I could not detect any change in the condition of the ossicular chain as a result of my manipulation of the malleus, there was, nevertheless a pronounced immediate gain in hearing. In such cases there are two hypotheses which might explain the functional gain, viz., (a) that I had broken or modified existing adhesions so as to allow of better response to sound waves; or (b) that the constringent effect of the cocaine on the swollen, or congested, tympanic mucosa may have led to better sound conduction. It is clear that the differentiation of these two influences might easily have been made had I retested the hearing after incision and use of cocaine and before my manipulation of the ossicles. Such a differentiation might throw some light on the treatment of certain cases.

To return to the influence of this procedure on hearing: I have in many cases obtained an immediate gain in hearing quite out of proportion to what would have been possible by other means. If I were able to report that these functional gains were in general as permanent as they were in some cases spectacular, there is no doubt that we would have a valuable means of treating certain types of deafness. Unfortunately I am obliged to report that the results in most cases were not permanent. There has been no other case in which a functional gain comparable to that reported in Case 1, has been maintained; and the ultimate results have proved too uncertain, and as a whole of too negative a character to justify its mention as a therapeutic measure for the relief of deafness. On the other hand, the very unusual temporary gain obtained in certain cases would seem to indicate most clearly the need of further investigation, by any rational means, of the actual mechanical obstacles to sound transmission. Only along such lines will any real advance be made in the treatment of advanced tympanic deafness.

TREATMENT

Any detailed account of treatment would be as futile and wearisome as it would be out of place before the members of this society. Instead, I shall refer very briefly to certain more or less commonly accepted dogmas, belief in which seems to be based more on frequent assertion and repetition than on the observation of actual facts.

1. In relation to the treatment of the eustachian tubes, there are two time-honored superstitions which should be disposed of. The first is that the passage of a current of air through the tube from the catheter or Politzer bag exerts any permanent therapeutic influence on a chronically diseased tube; and the second is that the use during inflation of medicated vapors—e.g., menthol, ether, iodin, etc.—exerts any alterative and beneficial action on the tubal mucosa. Evidence of

the value of either of these agents, so far as chronic tubal lesions are concerned, is wholly wanting.

The minutiae of the treatment of diseased tubes—whether by bougies, sounds, electrolysis, the local use of drugs, etc.—do not call for special discussion here. All have their value in the presence of certain conditions which are recognized by all experienced aurists. Eustachian bougies, while of great value in certain conditions, simply exert pressure the effect of which in many cases is only temporary. If we associate force with a bougie which is too large for the caliber of the canal at the isthmus, a laceration of the mucosa may occur giving rise ultimately to an organized annular stricture more intractable than the original tubal lesion.

In my own experience the treatment having the widest scope of usefulness in chronic tubal lesions is the local application of the silver preparations—chiefly argyrol and silver nitrate. Yankauer's method of first cocaineizing the entire length of the tube and then making direct application of a 25 per cent. or 50 per cent. solution of argyrol, also throughout the length of the tube, gives the best results.

2. As to the influence of inflation in advanced tympanic deafness: If a first inflation is followed by an appreciable improvement of hearing, this may be accepted as an indication that the ears should be inflated at short intervals—preferably on alternate days—until the maximum functional gain shall have been reached. In my experience, progressive improvement can rarely, if ever, be carried beyond the third, or possibly the fourth inflation. Beyond this, if the inflations are continued at short intervals and over any considerable period of time, there is likely to occur an ultimate recession, or loss, of hearing power, due to a loss of the normal tone or tension of the drum membrane.

I do not mean to suggest that the use of the inflating apparatus should be altogether abandoned; for even after the maximum functional gain from inflation has

been obtained, the catheter is still an essential instrument through which to carry out the local treatment of the tube. In other words, the inflating bag may be an essential and useful instrument when used occasionally and gently for the purpose of determining the condition of the tube, or a harmful and dangerous one when regarded as a means of exercising the drum membrane and ossicles by frequent and forcible inflations.

The subjective phenomena following inflation are such as render it difficult for either the physician or the patient to differentiate with certainty between the immediate and the ultimate results. In many cases, following inflation, the walls of the membranocartilaginous tube fall again into contact, their congested condition serving to maintain for a time a positive air pressure in the tympanum. While this lasts, the patient experiences the sense of relief and clearer audition dependent on the more normal position of the drum membrane. As soon, however, as the air in the middle ear is absorbed, the drum membrane resumes its retracted position. Frequent or injudicious repetition of inflation brings further abnormal relaxation of the membrane, with more pronounced retraction, and a progressive loss of hearing. The initial results of inflation are sudden and therefore clearly appreciable; the ultimate results of prolonged routine inflation are gradual, insidious and therefore difficult to gauge.

My own experience and belief are that more of actual and permanent functional gain can be accomplished through treatment directed solely to the diseased lining membrane of the eustachian canals than can ever be obtained by routine catheter inflation.

The correction of ossicular rigidity by some form of non-surgical treatment is a problem of which no satisfactory solution has yet been found. "Pneumatic massage" is a term, formerly in more common use than now, applied to passive movements of the drum membrane by means of any instrument producing alternate

condensation and rarefaction of the air in the external auditory canal. It has been widely advocated and tried out, and has been found wanting.

I have long believed that exercise of the conducting mechanism, to be effective, should fulfill two conditions, both of which are violated by the usual form of pneumatic massage, viz.: (1) the *membrana tensa* should be made to execute movements simular to those induced by sound waves; and (2) the number of vibrations per second should bear some definite relation to that note in the musical scale which marks the lower limit of the patient's tone perception.

With patients whose lesions are confined to the tympanum, I have proved experimentally—at least to my own satisfaction—that the ossicular chain may be thrown into more or less vigorous vibration down to and below the estimated lower tone limit by a system of tuning forks properly designed for this purpose. If impressions of sound reach the inner ear chiefly through vibrations of the conducting mechanism in response to sound waves from without, why may we not make use of selected sound waves to exercise the drum membrane and ossicles in just those movements (sounds) for which their mobility is shown to be impaired? If, for example, it be shown by careful testing with small forks (for example, the Hartmann set) that the hearing is impaired, but not actually lost, for a given note, for example, c (128 d.v.), why is it not a rational and logical procedure to exercise the drum membrane and ossicles for that particular tone by means of a larger fork of the same pitch whose greater amplitude of vibration is sufficient to throw the drum membrane into more vigorous vibration?

The tuning forks employed by me were expressly designed for experiments in the exercise of the ossicles. They consist of a set of large unclamped forks, the prongs of which are $\frac{3}{4}$ inch wide and as nearly as possible of uniform thickness; the variations in pitch being regulated by graduations in the length

of the prongs. They produce all the full tones of the musical scale from C-2 (32 double vibrations) to c² (512 d.v.), four octaves higher. They present broad, flat surfaces which when set in maximum vibration and held close to the ear, cannot fail to throw the drum membrane and ossicles into more or less vigorous motion. To illustrate their use, let us suppose a case of tympanic deafness in which the lower tone limit has been roughly estimated by means of the Hartmann set of tuning forks. If, for example, the patient can hear Hartmann c¹ fork (256 d.v.) but not the c fork (128 d.v.), the tone perception is further tested by forks representing the intermediate notes of this octave—that is, 240, 213, 192, 170, 160 double vibrations, etc.—until the correct lower tone limit is reached. For testing purposes the forks should be struck with only moderate force and held with the space between the prongs opposite the ear.

Supposing that the lower tone limit is shown by this test to be neither 128 d.v. nor 256 d.v., but the intermediate tone of 160 d.v., this fork and three or four others immediately below it in the musical scale, (that is, 144, 128, 120, 107 d.v., etc.), are employed for exercising the drum membrane and ossicles. Using first the highest fork, 160 d.v., it is set in maximum vibration and held with flat surface of the prong close to the ear until no longer heard. This is repeated ten or twelve times. Then the next fork, 144 d.v., is used in the same way and so on through the series of successively lower forks, until one is reached which cannot be heard even momentarily in maximum vibration. Used in this way tones several notes lower will be heard. Letting the ear now rest for one or two minutes, it will be found in certain cases that an appreciable though moderate gain in hearing has been obtained.

To guard against possible misapprehension, I wish to state clearly the limitations of this procedure. It obviously cannot be expected to break up old or firmly

organized adhesion bands within the tympanum. It may, on the other hand, render certain adhesive processes less rigid and to this extent bring about an increase of joint mobility with proportionate functional gain. It is therefore of greater efficacy in moderate than in advanced grades of functional impairment. It should in fairness be spoken of only in comparison with other advocated methods of combating ossicular rigidity. In this light, its advantages may be stated as follows: In theory it is a rational measure in that (1) it calls for no exaggerated excursions of the drumhead nor for movements having no relation to the function of sound transmission; and (2) it forces the drum membrane and ossicles to vibrate in response to just those sound waves, or tones, for which their mobility is known to be impaired.

In actual practice the results have varied considerably in different cases, some being aided while others have shown little or no improvement. As offsetting failures, there have been no untoward results.

In the foregoing pages, I have outlined what in my experience have proved the more practically useful measures in advanced tympanic deafness. It is clear that if we are to make practical headway in lifting the handicap under which many of these patients labor, we must ultimately develop our work along other lines and broaden somewhat our conception of the task before us. We must discard the idea that the hearing by the patient of an acoumeter a few inches or a few feet further from his head, while he is still hampered by practical inability to interpret the average conversational voice, represents a practical success. From the patient's view-point it is a failure; and the only consideration which leads him to regard it as of value to him is the fact that he views this somewhat negative result in the light of a milestone marking what he believes to be his progress toward better results, or as an anchor by which he resists the current toward hopeless deafness.

I have during the past two years given a good deal of time to hearing tests, and particularly to an effort to place our tests of hearing for conversational speech on a more exact basis; in a word, to developing a simple qualitative test, or one showing the relative auditory acuity for the various speech components. These studies have led me to somewhat unexpected conclusions in certain directions having, it has seemed to me, a practical bearing on the interpretation or management of certain forms or grades of deafness. They fall too far outside of the scope of this paper to be included here. They may be made the subject of a later report.

58 West Fifty-Sixth Street.

ABSTRACT OF DISCUSSION

DR. JOHN R. PAGE, New York: I recall the particularly brilliant result in the case referred to in the paper. I have intended trying the operation and found one case in which I thought it would be well worth while; but the patient asked if there was any danger attached to it and I said that possibly there was, as I recalled a case in which Dr. Kerrison got considerable traumatism or infection that caused considerable alarm, did you not, Dr. Kerrison?

DR. KERRISON: Yes, I had one case. Many of the cases had physical signs of acute inflammation. In one case there were mastoid symptoms. It is obvious that there is a chance of infection of the tympanum and, of course, it might go on to mastoiditis, but if you are careful in your technic the danger is slight. All the cases have healed quickly.

DR. GEORGE L. RICHARDS, Fall River, Mass.: How did Dr. Kerrison determine that he got movement of the stapes?

DR. NORVAL H. PIERCE, Chicago: From Dr. Kerrison's preliminary remarks, I gathered that he cut a hole in the membrane to ascertain the mobility of the stapes. That procedure was tried by Schwartz away back in 1872, I think, and it was discarded, first, because one could not ascertain the mobility of the stapes by touching it, and because Bezold proved that he could demonstrate its fixation by functional tests. He showed that the sound waves get into the labyrinth in two ways; up to thirty-six vibrations they are conducted through the stapes by wave vibration; then, the entire ossicular chain vibrates *en masse* and gradually beyond that it passes in by molecular vibration. He proved this by observations on patients during life and observations after death by microscopic examinations. Therefore I do not

believe that we should revive this old idea of cutting a hole in the membrane to ascertain the mobility of the stapes. I have operated in the past, some years ago, in quite a number of cases of what we know now to be fixation of the stapes, and I always failed of improvement, and I have had several results that were very distressing; one in which complete facial paralysis occurred and remained permanent. In several others infection of the mastoid occurred; none that required operation but which caused a good deal of worry. It is impossible, I think, to obtain any permanent results by cutting a hole in the membrane and putting a hook around the handle of the malleus to try to work the adhesions loose. One occasionally gets slight improvement, but it passes away as soon as the membrane heals up. I have had pronounced benefit to hearing from ossiculectomy in cases in which the ossicular chain was demonstrably bound down by adhesions between the promontory and the umbo. One case of this type was particularly instructive; Neuman's method of local anesthesia was attempted. When the cocaine was injected under the periosteum in the bony canal, I was surprised to see quite an enormous cholesteatomatous mass project out of the rather small opening in the membrana flaccida and it occurred to me that that might be a very good treatment for certain cases of cholesteatoma. The entire epitympanic space was irrigated and emptied. I got no anesthesia, however, in this case, because the fluid was not retained. General anesthesia became necessary. Before proceeding with general anesthesia, and after washing out the cholesteatoma, I tested the hearing and found it considerably improved. The hearing was increased considerably and permanently by the ossiculectomy and the cholesteatoma was cured. She could hear a whisper only within 3 feet before operation; afterward something like 15 feet. I think we should be careful, however, not again to revive a hope that has long since been buried in our otologic experience, namely, that by merely dividing or breaking up adhesions within the tympanic cavity, especially if they are of any considerable extent, we may obtain permanent, considerable improvement.

DR. W. S. TOMLIN, Indianapolis: I have had some slight personal experience along the line given us by Dr. Kerrison, my attention having been called to it by Ruttin in Vienna. He didn't recommend incision of the drum, but devised a hook which I have used in three cases. In one the result was good and in the other two not so satisfactory. I found it necessary to follow up the operation with the more or less standard treatment for chronic catarrhal otitis media. The treatment may be followed out along the lines following the Heath operation. I have been inclined to consider that in a certain proportion of the cases in which Heath gets increased hearing after his operation it may be due to the

fact that he is persistently keeping the middle ear dilated and keeping down adhesions following the operation. We are not able to measure the movement of the stapes, but if we can affect the movements of the malleus and the stapes is not bound, it will move in proportion of inverse geometric progression. While these adhesions have been going on the individual may find that he can increase his hearing by blowing his nose, and in one case I found marked distention of the drum membrane from this cause. In it there was increased benefit by a thickening of the drum following the use of irritants. The indications for the procedure are: (1) of course a reduced hearing; (2) negative Rinné without absolute increased bone conduction; (3) markedly better hearing with audition tube; (4) retracted drum with restricted malleolar movement; (5) the other evidences that the stapes is movable. It has not seemed to me indicated in the presence of active inflammatory processes.

DR. S. MACCUEN SMITH, Philadelphia: I doubt if Dr. Kerrison can hope to have any permanent results from this procedure. Some years ago I performed a number of operations, following the example of Sexton and others; there was a series of about 168 cases, and they were, with few exceptions, decidedly spectacular in point of immediate improvement. They were also notable, with several exceptions, from the fact that the subsequent loss of hearing was as rapid as would have occurred without operative interference. Following up the cases in later years, I thought they lost their hearing even a little more rapidly than if I had not operated. I am much inclined to adhere to a memorable saying of St. John Roosa, some years ago: After listening to a number of papers on the improvement of hearing in these cases, he said: "They will probably hear when Gabriel blows his horn, but not before."

DR. P. D. KERRISON, New York: I wish to make it clear that I had no intention of proposing the method of examining the ossicles described in this paper as a new treatment for deafness. A careful reading of my paper will show that there is no ambiguity of statement and therefore no reason for misinterpreting my meaning on this point. I do believe that the usual management and treatment of these patients is unsatisfactory, and that a revision or an analysis of methods and results is therefore desirable. I agree absolutely with Dr. Pierce's remarks on the treatment of otosclerosis, first because they are logical, and secondly, because they are in accord with my own personal experience. It is evident from the discussion that there has been some misunderstanding of the purpose of my paper. This, I think, has been due largely to the haste and necessity for skipping parts in reading. My meaning will be made clear to those who may read my paper when it appears in *THE JOURNAL*.

INDIRECT INTRALARYNGEAL METHOD FOR REMOVAL OF BENIGN NEOPLASMS

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In his book on diseases of the throat, Solis-Cohen¹ quotes two cases of removal of laryngeal growths through the mouth, one by Koderick of Brussels in 1750, the other by Green of New York in 1845. These were done in antelaryngoscopic days, but no details are given. In the literature, but seventy cases are mentioned before the invention of the laryngoscope. In Sir Morell Mackenzie's list of 100 cases of laryngeal tumors operated on by him, and reported in 1880, sixty-seven were said to have been papillomas. Of sixty-six consecutive cases operated on by Solis-Cohen, reported in 1871, forty-eight were assumed to be papillomatous in origin.

According to Cohen and Mackenzie, next in frequency occur the fibromas. Moritz Schmidt, however, quotes the frequency of fibromas to papillomas of the larynx in 32,997 clinical cases examined to be 256 to 46; they usually occur singly and are apt to be redder in color and are not usually pediculate. Myxomatous fibromas are usually larger, attaining the size of a Lima-bean or even greater. They are generally pediculate and paler in color; they may be globular or pyriform in shape, and occur on the epiglottis as well as on the cords. They are rarely encountered. True myxomas are also but seldom found. Sir Morell Mackenzie reports but one in his 100 consecutive cases of laryngeal growths. They are translucent semipink or red-

1. Solis-Cohen: Diseases of the Throat. New York, William Wood & Co.

dish, and generally pediculate, varying much in size. Their most frequent seat is in the anterior commissure of the cord.

Angiomas are purple in color and occur on the ventricular bands and epiglottis, rarely on the cords.

Lipomas may occur on the arytenoids, epiglottis or ventricular bands. They are characteristic yellow tumors.

Cystomas may occur on the epiglottis or on the ventricular bands and more rarely on the cords. They are usually sessile, translucent and pale in color, and of semifluid contents.

Chondromas are made up of hyaline cells and are cartilaginous in origin, usually springing from the cricoid, thyroid, epiglottis or arytenoid cartilages.

Singers' nodules (chorditis nodosa) occur on the vocal cords at the junction of the anterior and middle third; they are usually bilateral and are composed of stratified epithelium.

Polypi present the appearance of the usual polyp.

Pachydermia are of epithelial origin and attain a much larger size than an epithelial nodule on the cord. They are found most frequently in the posterior portion of the cords, invading the respiratory tract. A peculiar characteristic seems to be that they are usually bilateral, and the conical apex of one fits into a depression in the other, or in case they are on one cord, the hard apex makes a corresponding depression in the other band.

Sarcomas present no especial feature to the unaided eye. Cohen states that removal of a benign growth through the mouth is much less apt to terminate fatally than through external openings and that recurrence is less likely to follow.

Sessile papillomas are apt to return after operative procedure, if the seat of the wound is not sufficiently cauterized after the removal of the growth. This may be accomplished by Tobold's concealed silver nitrate stick, or by chromic acid fused on a laryngeal probe.

The instruments used for removal of laryngeal growths by the indirect method have not been improved on very much since 1880. The methods of removal advocated by most writers include the forceps, cauterization by acids or silver nitrate, and by the galvano-cautery. In the local treatment of papillomas, Dundas Grant has spoken well of the continued application of a 2 to 5 per cent. solution of salicylic acid in absolute alcohol, while Delavan has reported a case of multiple papilloma cured by a spray of absolute alcohol used six times daily.

In speaking of the growths which occur in the larynx, it is not my intention to advocate the indirect intralaryngeal method in their removal. I have been asked simply to demonstrate the possibilities achieved by deftness as a result of experience, and speak of the instruments which are generally employed.

Of the numerous instruments invented for the removal of laryngeal benign neoplasms, we must first mention the laryngeal snare of Carmalt Jones, and that of Gibb, and also the port-caustic of Jarvis, and that of Tobold, as well as the sponge probang first mentioned by Voltolini. Fauvel was the first operator to devise the laryngeal forceps, which were modified and improved by Sir Morell Mackenzie. These are described by Lennox Browne.² The guarded forceps of Dundas Grant is an instrument of special value in the removal of pediculate growths on the cords. The universal forceps of Watson Williams are in certain cases to be recommended. Sir Morell Mackenzie's cog-wheel ecraseur must not be overlooked nor the various snares of many other authors, described by Watson Williams.³ Curets are of use in removing growths of a sessile variety, and those occurring beneath the anterior commissure. Heryng has constructed a variety of these, as have many operators. The Krause-Heryng double curet forceps⁴ are used in

2. Browne, Lennox: *Throat and Nose*, Ed. 4, 1893, p. 131.

3. Williams, Watson: *Diseases of the Respiratory Tract*, 1901, p. 224.

4. Ballenger: *Diseases of the Nose, Throat and Ear*, p. 522.

Europe, but seldom in this country. The first of this kind of forceps was invented by Stoerk, and modified by Schroetter, both of Vienna; Mackenzie,⁵ who describes them in his text-book, also invented a tube forceps, a wire within operating on one or both blades. Gottstein's laryngeal forceps⁶ had their place in the evolution of the instruments employed in the early eighties. To-day, however, we have gone back to the general shapes of Fauvel and Mackenzie, and I will present some of the modern modifications of the same, and especially the universal handle of Meyrowitz with laryngeal and sphenoid tips of Krauss and Cordes.

Various forms of epiglottis lifters have been devised for the better observation of the larynx during operative procedures. Among the best are Mount Bleyer's and Escat's.⁷ These instruments are of the greatest assistance in cases in which an overhanging epiglottis is encountered. A downward and forward pressure at the base of the tongue in front of the epiglottis causes the latter to assume the perpendicular. These instruments are very useful in cautery work.

The preparation of the patient for operation is a simple one:

Cleanse the throat and larynx with an alkaline spray, and then spray into the larynx a 4 per cent. cocaine muriate solution in small quantity. Touch the uvula, pillars and posterior pharyngeal wall with the same solution with a cotton applicator, and massage these parts with the applicator to accustom the throat to the feel of the instrument. Have the patient hold out the tongue with a napkin, or have an assistant, in case the epiglottis is in the way, use an Escat epiglottis lifter. The head of the patient should be steadied by a nurse and the instrument introduced, by daily practice if necessary, until all fear on the part of the patient is overcome. In operating it is well to educate the patient

5. Mackenzie: *Diseases of the Throat and Nose*, 1880, p. 187.

6. Bosworth: *Diseases of the Nose and Throat*, 1892, p. 735.

7. Grant, Dundas: *Brit. Jour. Laryn., Rhinol. and Otol.*, December, 1904.

to use the vowel sound *A*, changing to *E* without moving the tongue. The *A* changing to *E* brings the cords on the highest plane possible, and gives the best view of them in their fullest extent. Then without dropping the cords and in the *E* emission, at the command, "Now," the patient should be taught to take a deep breath suddenly without making any sound or body movement, and with complete relaxation. At that instant the forceps are introduced and the growth is seized. This applies to subglottic growths and those on the border of the cords. Growths situated on the upper surface are removed during the *E* emission. It is surprising how skilful one may become in this procedure, so much so, that having habituated oneself to this method, direct laryngoscopy seems really more difficult.

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THE DIRECT METHOD OF INTRALARYNGEAL OPERATION

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In presenting the subject of the direct method of intralaryngeal operation, I do not wish to be considered as championing any particular method. Every laryngologist should be familiar with every method and select for operation in the particular case the method which suits best his personal equation for that case.

The indirect, or mirror, method can be used only in adults. Its greatest disadvantage is that in the guidance of the forceps it requires a movement backward when the image shows that a movement is needed forward, and for a diagonal motion it is necessary to combine a reversed anteroposterior movement with a true lateral movement. In the direct method, all movements are under the control of the eye and are made directly. This does not mean, however, that practice is not required. Many difficulties are to be overcome by continual practice before safe and accurate operation is possible. To begin with, the gaging of depth by one eye only presents much the same problem as in indirect operating. All general considerations and the control and cooperation of the patient, as considered by my associate, Dr. Curtis, are, of course, equally applicable to the direct method. One point that seems not to be so well understood as it should be is the fact that the direct method affords a different point of view from that obtainable by the indirect or mirror method, which will be readily understood by reference to the schema, Figure 1. Moreover, the

larynx being more or less drawn on, the upper orifice is elongated, the aryepiglottic folds are rendered more prominent, the epiglottis is invisible, being hidden by the tube, and the larynx is seen at its true depth instead of foreshortened as with the mirror.

In operations for any form of stenosis of the larynx in children, such as papillomas, subglottic edema, posttracheotomic and postintubational stenosis, etc., the safety, promptness and accuracy with which intra-

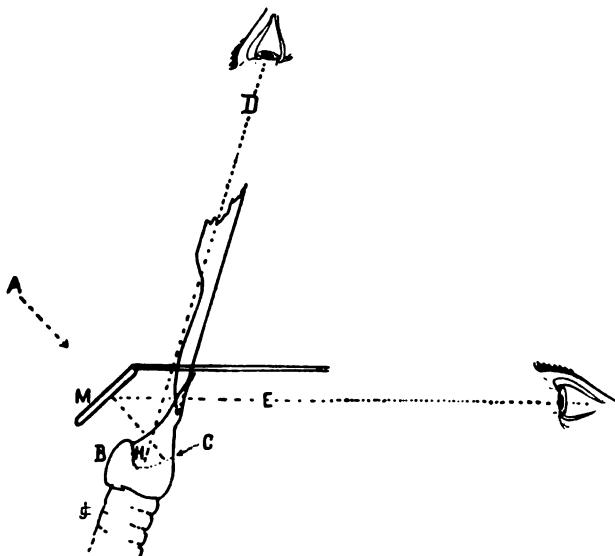


Fig. 1.—Schema illustrating the difference in the point of view by the direct and the indirect method. The observer's visual axis at *E*, looking into the mirror, *M*, gets an image as if he were looking from a point of the patient's head, *A*.

laryngeal operation can be performed places direct laryngoscopy on a plane of advantage equaled only by its usefulness for diagnosis in these conditions. Great care must be taken in all endolaryngeal operations, direct or indirect, to impair laryngeal motility as little as possible, because as I have demonstrated, it is the tugging of the arytenoid on the cicatricial tissue that is the most important factor in the development of an adventitious vocal band.

Anesthesia.—For adults, I prefer local anesthesia with an 8 per cent. cocaine solution supplemented by a few touches with a minute quantity of 20 per cent. solution to the interior of the larynx. In a few cases, for operations of extreme nicety, such as the plastic formation of adventitious vocal cords, and for the removal of benign growths which are obliterated by the ischemia produced by cocaine, a general anesthetic may be necessary in adults. In children, the use of a general anesthetic in any case of stenotic laryngeal disease is extremely dangerous, because respiratory arrest is

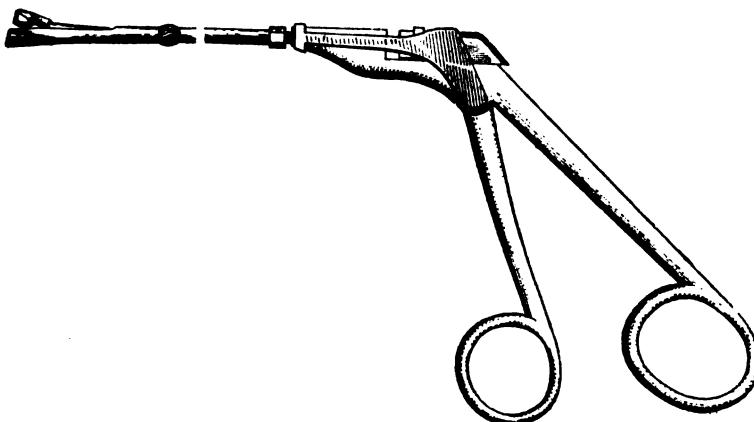


Fig. 2.—Tissue forceps found most frequently useful in intralaryngeal operations by the direct method.

practically certain to follow as soon as the patient is sufficiently under the anesthetic to lose the aid of the voluntary accessory muscles of respiration. Tracheotomy, or what is very much better, the prompt insertion of a bronchoscope with artificial respiration and bronchoscopic oxygen insufflation, will save the patient's life; but in view of the hazardous nature of general anesthesia in this particular class of cases, which is out of proportion to the dangers of general anesthesia in the usual run of cases, I have always urged strongly in favor of no anesthesia. Cocain is extremely dangerous in children and as I have abun-

dantly demonstrated, endolaryngeal operation is not painful and is so quickly done that anesthesia seems a needless risk. Particularly dangerous is the combination of chloroform and morphin, which are synergistic in the paralysis of respiration.

Position of the Patient.—For adults, under local anesthesia, the sitting position is preferable. Both patient and operator sit on stools, the patient being slightly lower than the operator. Sitting behind the patient is an assistant who supports the head preventing its rotation and preventing the patient from throwing the head backward (Fig. 3). If left to himself, the patient will naturally throw his head backward into the position of a man about to be shaved in a barber chair, which makes exposure of the larynx extremely difficult. An extreme forward position of the head and neck without excessive extension is preferable. The recumbent position is preferable in children. In operating on children without anesthesia, I have one nurse hold the knees of the patient down on the table; another nurse holds down both wrists, and the first assistant holds the patient's head high in the Boyce position of moderate extension. The degree of extension is less important than the very high position of the head (Fig. 4).

Instruments.—The operator should try all the different forms of instruments and illumination in order that he may take advantage of the particular instrument that best suits him in the particular case. I prefer the distally illuminated laryngoscope. The choice of instrument, however, is of less importance than that the operator shall have had adequate practice with it. For general operative purposes, I have found nothing superior to the tissue forceps shown in Figure 2, which have the great advantage of biting into the lateral wall with much greater facility than any form of sliding-punch forceps; lateral pressure cannot be made on a punch forceps, whereas the jaw of the tissue



Fig. 3.—Position of adult patient and operator in intralaryngeal operation, first stage. After the epiglottis is exposed and passed, the patient's head is dragged downward and forward toward the operator.

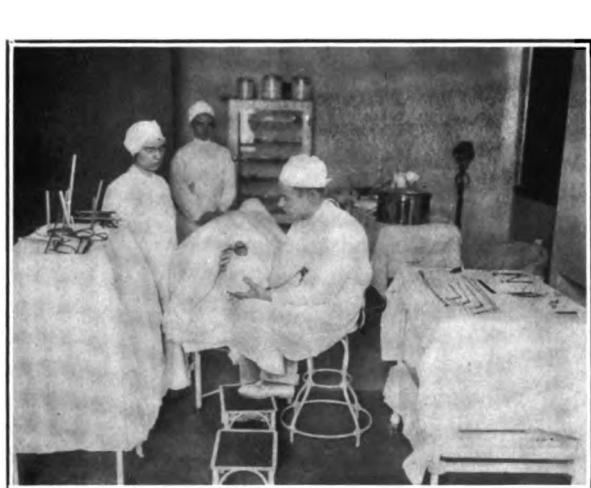


Fig. 4.—Position of patient and assistants for examination and intralaryngeal operation without anesthesia in children.

forceps will drag it laterally into the bite. I use duplicate forceps so that a fresh pair is handed to me immediately without delay for disengaging the extracted growth from the "basket" of the first forceps used.

Asepsis.—While we cannot sterilize the field, the patient's mouth should be thoroughly cleansed with a tooth-brush and rinsed with alcohol in 20 per cent. solution, which is the best non-toxic antiseptic. The patient's head is covered with a sterile cap having an opening opposite the mouth and the operator and all his assistants go through the regular operating room sterilizing technic. The operator should wear a mask for the protection of himself as well as the patient and should provide himself with protective glasses, or his regular glasses, in duplicate, to facilitate cleansing and replacement when spattered.

Technic.—To operate efficiently with forceps requires the coordinate movement of the left hand holding the laryngoscope, leaving the right hand free to use the forceps. In order to acquire this knack of coordination, it is necessary always to practice exposing the larynx, even when done only for diagnosis, with the left hand, never with the right. If this be done, not only is coordinate use of the laryngoscope and forceps in operating acquired, but the left hand develops the knack (rather than the strength) required for prolonged laryngeal exposure, should prolonged exposure ever be required.

First Stage.—The patient being in position shown in Figure 3, the operator, holding the laryngoscope in his left hand, while protecting the patient's lip by elevating it with his right index-finger, inserts the spatular extremity and depresses the tongue until the tip of the epiglottis comes into view (see schema, Fig. 5). Absolutely no effort should be made to see the larynx until the first stage of exposure and identification of the epiglottis is complete.

Second Stage.—The spatular end is inserted slightly deeper, posterior to the epiglottis, being careful to keep the tube in the middle line, over the dorsum of the tongue. If the laryngoscope is inserted too deeply, the spatular end will get behind the arytenoid and the operator will be looking down toward the esophagus. In this event, it is necessary to start over again at the first stage.

Third Stage.—Exposure of the larynx consists in a downward and forward traction with the tip of the laryngoscope as shown by the dart in Figure 5. Under no circumstances should counterpressure be made on

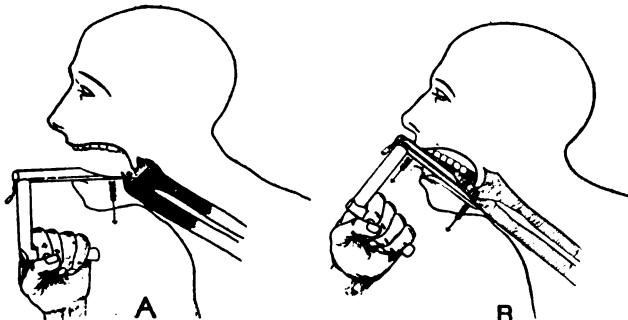


Fig. 5.—Schema showing the first and third stages of laryngeal exposure. At *A*, the tongue is seen depressed as indicated by the dart, causing the epiglottis to project into the line of vision. The second stage, not shown here, consists in a deeper insertion of the tube. At *B* is shown the third stage, the drawing forward of the epiglottis and all the tissues attached to the hyoid bone with the tip of the spatular end. The left hand is always used for holding the laryngoscope.

the upper teeth as a fulcrum. The patient's entire head must be pulled downward and forward with the laryngoscope.

Direct Laryngoscopy by the Lateral Route.—In the foregoing description, it is directed that the instrument be inserted over the dorsum of the tongue and kept in the middle line. This is essential until the operator has acquired the knack and is thoroughly familiar with all the landmarks. Considerable strength of wrist is necessary to cause displacement forward of the tissues attached to the hyoid bone, especially in stout and mus-

cular subjects with short necks. In such patients it may not be possible to see the anterior commissure by that method. For all these reasons, I prefer the lateral route, passing the laryngoscope down at one or the other side of the tongue which rolls out to the opposite side and obviates the necessity of great displacement pressure. The side to be selected should be the one opposite to the involved laryngeal wall. By this lateral route, the anterior commissure can be exposed in any patient who can open his mouth, provided he be not allowed to throw his head backward, and provided the proper direction of traction downward and forward is maintained.

Removal of Growths from the Ventricle.—Growths whose origin is concealed in the ventricle are best exposed by the method which will be readily understood by reference to the schema, Figure 6.

Extubal Method.—For very large growths, the laryngoscope is used only to look through, the forceps being passed at the side of the laryngoscope and the closure of the jaws being under ocular control just beyond the tube mouth (Fig. 7).

Malignant Growths.—Following the initiative of Sir Felix Semon and Mr. Butlin, I have had such a high percentage of successes from thyrotomy in properly selected cases that I believe that to attempt endolaryngeal extirpation of a malignant growth would be a step backward. Therefore, endolaryngeal operation in malignancy is limited to the taking of a specimen for biopsy. For this purpose, the precision with which any desired portion of the neoplasm may be removed, along with sufficient normal tissue to give the histologist the best chance, has given to the laboratory report an approximate infallibility never before approached with the inadequate specimens usually obtained by indirect removal of a specimen.

Benign Growths.—In the removal of benign growths, the question arises whether it is better to

slice the growth off even with the surface, or to bite into the apparently normal basal tissue. The first factor to be considered is the avoidance of any injury to the laryngeal motive mechanism. The arytenoids are particularly to be avoided and the muscular structures should be injured as little as possible. In case of growth involving the edge of the cord, it may be well to submit the matter to the patient for decision

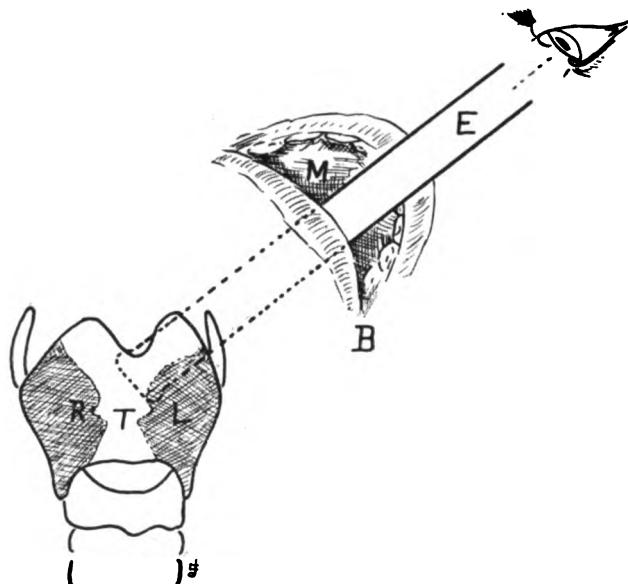


Fig. 6.—Schematic illustration of manner of exposing a tumor located in the laryngeal ventricle. The larynx is fixed by the hand of an assistant externally while the head of the patient is drawn down laterally to the side opposite the ventricle containing the tumor.

(Sanders), explaining to him that if the growths are sliced off even with the surface the chances of recurrence are greater than if removed more deeply, but deeper removal will temporarily impair the voice. Many patients will prefer a superficial removal, deferring more radical extirpation until recurrence takes place. This is especially true of professional voice users. Other patients dread the word operation and

will choose radical removal as the best chance for avoiding a second operation.

Papillomas.—Papillomas in children are by far the most common of all laryngeal growths. Thomas J. Harris¹ has had excellent results from the use of radium applied by the direct method.

Harmon Smith² has had excellent results from fulguration.

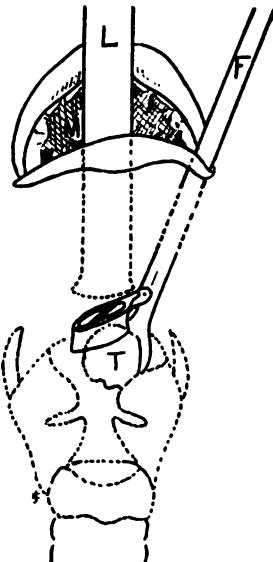


Fig. 7.—The author's "ex-tubal" method for endoscopic removal of the epiglottis and growths originating in the upper orifice of the larynx. This method renders easy the removal of very large tumors that formerly required subhyoid pharyngotomy. It is not used for small growths. The forceps, *F*, seize the tumor, *T*, under guidance of the eye looking through the tube, *L*.

The method which has yielded the best results in my clinic is removal with the forceps through the direct laryngoscope, repeated as frequently as necessary to nip off all recurrences in the bud. A little of the basal, apparently normal, mucosa is removed along with the growth. The superficially cicatricial mucosa which eventually results is an exceedingly

1. Harris, Thomas J.: Proc. Internat. Med. Cong., Sect. 15, London, 1913.

2. Smith, Harmon: Laryngoscope, February, 1909.

unfavorable soil for the growth of papillomas, and recurrences cease after a number of removals. Occasionally a single removal is successful, a number of cases being known to be free from recurrence at the end of from one to eight years. In the majority of cases, however, many removals are necessary; but as they are done without any anesthesia, general or local, frequent operation at close intervals is unobjectionable. After a few sittings, most of the children do not resist or even cry. In the interval between operations, the local application of alcohol, as recommended by Delavan many years ago, hastens the hardening process. An alcoholic solution of salicylic acid, used by E. L. Jones, is also an excellent application.

It is necessary to remember that there are two general classes of cases: In some instances a single removal is sufficient; in others a most stubborn tendency to recurrence is manifest, papillomas of children being more persistently recurrent than those of adults.

Laryngeal Stenosis.—Laryngeal stenosis, when hypertrophic in character, may be excised with the forceps when it overhangs the upper orifice of the larynx. Subglottic hypertrophic stenosis, as I have abundantly demonstrated, is readily amenable to galvanocautery treatment, the incisions being parallel to the long axis of the trachea and into the most prominent portion of the hypertrophy. Care should be taken not to cauterize deeply and not to touch the cords.

Laryngeal Tuberculosis.—Galvanocautery puncture for the treatment of laryngeal tuberculosis in all patients whose pulmonary condition is not too far advanced has yielded excellent results when indirectly applied by Heryng, Hajek, Mermad and Bar. Intralaryngeal applications as shown by Kahler can be made perpendicular to the surface by the direct method instead of the more or less linear application usually made with the mirror. This disadvantage of

the indirect method can be overcome by using the right-angled point as advocated by Sir St. Clair Thomson.

Cicatricial and Congenital Webs of the Larynx.—Webs may be removed by the punch forceps provided there is a large redundancy of tissue. When the web is thin and tense, without redundancy, the incision with a view to the plastic formation of an adventitious vocal band, using the long straight direct laryngeal knife, will yield most excellent results as to the cure of the stenosis and restoration of the voice.

CONCLUSIONS

1. The direct method is the only one by which the larynx in children can be operated on.
2. The indirect, or mirror, method is applicable only to adults. The reversal of the image sagittally, without reversal laterally, compels the operator to develop the ability to move his forceps backward when the image appears to require the forward direction; and, more difficult still, is the necessity to combine for diagonal movement a reversed anteroposterior with a true lateral movement.
3. The difficulties to be surmounted by the direct method of intralaryngeal operation require prolonged and constant practice, but not nearly to the same extent as required by the mirror method.
4. No anesthetic, general or local, is necessary for operations on the larynx in children. In them, cocaine is dangerous in any case, and general anesthesia is absolutely contra-indicated in all cases with even the slightest degree of laryngeal stenosis. Local anesthesia should be used in adults, general anesthesia, preferably with ether, being required only when cocaine is contra-indicated or when the ischemia accompanying its use causes the growth to shrink to such an extent as to hinder accurate removal.
5. No one method can be said to be best for all cases and all operators. The laryngologist should try

all methods and instruments so that he may decide for himself what best suits his personal equation and be prepared to use the method which, in his hands, is best adapted to the particular case.

6. Finally, any one who has the skill of Holbrook Curtis in the removal of benign growths by the indirect method, or of Thomas J. Harris in the indirect method of application of laryngeal galvanopuncture, will have no need of the direct method of intralaryngeal operation in adult patients.

Ninth and Penn Avenue.

METHOD OF SUSPENSION (KILLIAN)
DEMONSTRATION OF THE LATEST FORM OF THE
APPARATUS

ROSS HALL SKILLERN, M.D.
PHILADELPHIA

CHOICE OF ANESTHESIA

After trying cocaine, scopolamin and ether I and my associates unhesitatingly state that ether is by far the anesthetic of choice. Scopolamin has not been a success in our hands, although the technic as laid down by Killian, with even greater dosage, has been adhered to. Whether this lack of sufficient action has been due to the drug or to the difference in racial characteristics between the German and American, I am at loss to say. In our cases the patients were made only drowsy although 1/200 grain was twice and even three times administered in conjunction with morphin (1/64 grain), and in each instance it was necessary to resort to ether. The best form of administering the ether is the colonic method. The patient need not be apprised of the fact that he is being etherized and in this manner no apprehension on his part need exist.

DIFFICULTIES ENCOUNTERED

1. *Patients*—In order to procure a perfect view of the glottis it is almost necessary that the patient have a long, slender and supple neck. On this account this method of procedure is particularly adaptable to children as in practically every patient under the age of 12 we have been able to procure a good view of the anterior commissure. In short, thick-set individuals it is particularly difficult, and in older people with arthrosis it is absolutely contra-indicated. A good idea of its practicability on a given individual can be obtained by first endeavoring to examine him with the direct laryngoscope.

2. *Lights*—Either reflection from the indirect mirror, the headlight, or a light on the apparatus may be used. In our clinic the latter has been almost exclusively applied with almost complete satisfaction so far as illumination is concerned. The only fault at present is the tendency to slip off the mouth-piece and always at the most inopportune moment. If this mechanical fault were eliminated the device would be practically perfect.

3. *Operating-Room*—A special room is a great advantage although not absolutely imperative. The table on which the apparatus is fixed must be suitable for the purpose and adaptable to raising and lowering as the operator is seated, and must have his eyes on a level with the long axis of the patient's trachea. Arrangement of the theostat, instrument tables, etc., should always be approximately the same. A most important factor is darkening the room as in many of our modern general operating-rooms this is impossible.

INTRODUCTION OF INSTRUMENT

Care must be exercised in introducing the spatula, otherwise the following accidents may occur:

1. The spatula may not be deep enough, thus forcing the base of the tongue backward and obscuring the view to the glottis.
2. The spatula may not be in the median line of the tongue, causing a lateral bulging.
3. The spatula chosen may be too short so as to prevent the epiglottis holder from properly acting.
4. The clamp on teeth must be fixed and padded, otherwise the incisor teeth may be forced loose.
5. The spatula must not be forced into the mouth as the posterior pharyngeal wall may be lacerated.
6. While the patient is swinging, coughing must be guarded against as the hook may be thrown off the bar.
7. The patient in swinging position should have the shoulders resting on the table.

ADVANTAGES

1. A direct view of the larynx is continually present.
2. The operator is seated in a comfortable position.
3. The field is continuously illuminated.
4. A sufficient amount of working room for both hands is obtained.
5. The upper air-passages cannot be flooded with blood.
6. There is no danger of inspiration of blood or pieces of tissue.

PARTICULAR INDICATIONS FOR USE

1. Removal of intralaryngeal growth and hypertrophies.
2. Removal of foreign bodies in larynx and mouth of esophagus.
3. Curettage of larynx.
4. Diagnostic purposes.

2032 Chestnut Street.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRs. CURTIS, JACKSON AND SKILLERN

DR. ROBERT LEVY, Denver: The present generation, as distinguished from the older one that was expert in the indirect method, and that studied under the old masters, has something also to offer in the way of laryngologic skill. Among the younger men there are many whose early training, even within the past ten years, was sufficient to enable them to remove intralaryngeal growths by the indirect method. This in no way detracts from the importance of the direct method and the work of the early operators, but there is still much attention paid in the training of our specialists to the use of the mirror and manipulation by the indirect method; so that while the number of experts with the direct method become more numerous, nevertheless there are more men who are expert in the use of a mirror and the indirect use of the forceps than with the instruments used in endoscopy. So long as our teaching still enables us to perform operations with the mirror this method of removing growths and performing other manipulations within the larynx must of necessity continue. I would not in any way detract from the advantages of endoscopy. Many improvements have been made in the instruments since 1880 and Curtis has shown some. The double curet particularly is a great improvement. Another instrument of great value

is the Schlinamann forceps, an instrument which has at its extremity a small curve, so that the instrument may be placed in any position. It is capable of great nicety of manipulation. The overhanging epiglottis may be controlled by the Escat depressor but more satisfactorily in some instances by putting a ligature through the epiglottis. Then it is absolutely under control. This is particularly useful in operating under general anesthesia. Another method of operating within the larynx and one especially useful in large tumors is by means of the snare used in the following manner. Through the loop of wire one passes first a pair of laryngeal forceps the handle of which may be locked. The tumor is firmly held by the forceps and the snare-loop drawn completely over the growth. Gentle traction by an assistant draws the tumor by means of the forceps well into the loop at the same time that the operator passes the loop around the tumor. In this way the complete removal of a sessile growth is readily accomplished. One method Dr. Skillern did not speak of, though I am sure he has it in his paper, is that of bringing the anterior commissure into view by making counter pressure over the thyroid cartilage; another thing is that suspension is especially valuable in the case of children. There is no other method by which the child can be so easily operated on as by this one. With reference to anesthesia, Dr. Skillern said he used ether by preference. I question whether he would administer ether in every case to an adult on whom he desired to perform some simple procedure under suspension.

DR. HARRIS P. MOSHER, Boston: Naturally, when this procedure came in, rather extravagant claims were made for it. It has been in use now for a number of years and I think the consensus of opinion is that we need to modify those claims but little and that is saying a great deal for a new procedure. It is one of our great advances in the work on the larynx and upper end of the esophagus. Dr. Murphy said to me when this first came out, "What we need is simplification of the apparatus." It is rather complicated. If we can simplify the instrument or procedure in any way, it will be well worth while. I am familiar with the open speculum and tried to do what I could to modify that speculum and I think I can claim that now in 90 per cent. of cases it will work for this method of inspecting the larynx. When the procedure was introduced it was to be used under cocaine. I am glad it has been changed to a procedure under general anesthesia, because I work practically always with general anesthesia. The satisfaction of seeing the cords right in front of one and of watching the rhythmic movements is beyond expression.

Dr. Lynch of New Orleans, who recently read a paper at the meeting of the Laryngological, Otological and Rhin-

logical Society, has markedly extended the procedure and has devised instruments for dissecting out growths, papillomas, etc., in the larynx, and I feel that that is a great advance in the use of the suspension method. As for the removal of tonsils in this way, every one who speaks of it says that the tonsils can easily be removed by the suspension method.

DR. SYDNEY YANKHAUER, New York: I have used the suspension apparatus ever since it was first brought out by Killian and I endorse all that Dr. Skillern has said about the advantages of the use of this method for intralaryngeal work. I do not quite agree with Dr. Skillern about the particular instrument used. I had the original instrument as it was first brought out by Killian, and also this later model. The later model is much more complicated than the original and I find that with the original instrument and spatula I can bring the anterior commissure into view in practically every case without making counter pressure, and in every case with the aid of counter pressure. With the newer apparatus I haven't been so successful in this. The epiglottis lifter seems to be rather in the way. The tooth plate on the newer apparatus is larger and longer and gets in the line of vision. Killian uses the method very much in the removal of tuberculous lesions, which are generally in the anterior commissure. About a year ago I operated in a case of carcinoma of the epiglottis and the manner of the removal of the growth was so entirely different from anything that could have been previously done and the success was so much greater than by any other method that there was no question about the great advantage of this method. At the recent meeting of the Laryngological, Otological and Rhinological Society the removal of foreign bodies by the introduction of the bronchoscope with the suspension apparatus was spoken of. Some time ago I had a case of a tumor on the posterior wall of the trachea and tried this method. While I was able to remove the growth I was not quite satisfied with the aspect of the posterior wall and tried to introduce the tube, but the larynx first comes forward and then makes a bend downward, and I could not get behind that curve with the tube. Recently a patient was seen who said he had swallowed a fish bone. It was just below the cricoid cartilage. It was removed under local anesthesia by the suspension method. I can endorse what Dr. Skillern says about the introduction of the open tube into the esophagus being easier with the suspension apparatus, as it partly opens the esophagus, but after the entrance of the tube all advantage of the suspension method is lost and it is in the way. In the case in question I failed to see the foreign body and could only see the anterior wall and part of the lumen; I could not see the posterior wall. Therefore, the only advantage in pass-

ing the esophagoscope with the suspension method is the ease of introduction, but by this the mobility of the tube is sacrificed. If the extraction is difficult or the foreign body is against the posterior wall, the suspension apparatus interferes with movement of the tube and that is a very important objection.

DR. THOMAS E. CARMODY, Denver: I am glad to hear Dr. Yankauer speak of operating on the epiglottis. I have used this instrument about fifteen months and have examined some cases of tuberculosis in which we wished to remove the epiglottis, but being more familiar with the indirect method I used that. The experience of Dr. Yankauer as to impaired movement of the esophagoscope after introduction with the suspension apparatus has been mine also. There are two modifications, one of Lockard's, which has an eyelet so that the horizontal portion can be separated; the other is a vulcanite rubber pad on the tooth plate. This must of necessity be of the soft or velum rubber so as to conform to the shape of teeth or anterior part of palate.

DR. E. J. BERNSTEIN, Kalamazoo, Mich.: We are indebted to Dr. Curtis for his views regarding singers' nodes and his method of treating them. Just how much does Dr. Jackson think there is in Dr. MacKenzie's criticism of taking off a slice of growth for diagnosis? Most of us feel there is great danger in excising a portion of any growth for diagnostic purposes, as it may likely cause absorption by the lymphatics and bring about metastases elsewhere. I know such is the view in major surgery. In removing the breast for malignant growths, the surgeons first attach and tie off the arteries, veins and glands remote from the breast and cut wide and away from all involved structures.

DR. H. W. RIDPATH, Indianapolis: One can readily see that, in the removal of tonsils by the suspension method, the stretching open of the mouth in this position will bring considerable tension on the anterior and posterior pillars. That forces a portion of the tonsil into the median line and it will be found that the superior portion of the tonsil is drawn back into the cavity; therefore, in enucleating tonsils by this method one must be careful to get the superior lobe out, as otherwise it will be overlooked. One other point. We have in our clinic several patients in whom the tonsils had been partially removed or massacred by some other operator, and who were brought in to the hospital in a serious condition as to bleeding. On two occasions it was impossible for us to stop the bleeding by ordinary means, due to the amount of hemorrhage. The patient was put in the position in which blood would go down into the postnasal space and one could get a clear field and ligate without difficulty. One of our patients I am sure would have bled to death if we had not as a last resort used this method.

DR. OTTO T. FREER, Chicago: The direct method of entering the larynx has merely added to our powers, it does not supplant the older way of operating with the mirror; and to be an expert the operator must be trained in both methods. The use of the spatula tubes employed for direct laryngoscopy puts a strain on the muscles attached to the hyoid bone and on the thyrohyoid and hyo-epiglottic ligaments. This strain is borne by some patients with but little discomfort, but others suffer a good deal when much force is needed to get a direct view. However brilliantly done, direct laryngoscopy is a forcible entry into the larynx, while the indirect method has the advantage of entering along the natural curves. It is therefore incomparably the more elegant and gentle way and merely because he has not learned it, the operator has no excuse to turn to the rougher direct way in order to remove a papilloma from the cords or a foreign body from the larynx. I reserve the direct method for cases in which I cannot operate with the mirror as in the case of children. In younger children, because of the smallness of their laryngeal lumina and their ready closure by swelling, it is best to precede an intralaryngeal operation, as for laryngeal papilloma, for instance, by a tracheotomy. I have always used this precaution, and twice, once in an operation on a child for laryngeal papilloma and again in a case of a bone in the larynx, although all gentleness and speed were used, the larynx closed by swelling for a day or two and I was glad that I had my tracheal tube in place. I have heard of others, good operators, who have had to do a hurried tracheotomy after an intralaryngeal operation on a child and in one case the operator was too late. In holding the cutting forceps for operating with the mirror it is customary for many to enter the rings of the usual scissors-handle by placing the thumb in the uppermost ring. This hinders wrist flexion and so prevents the operator from reaching the anterior commissure with the beak of the forceps. When the thumb is placed in the lower ring and the index finger in the upper, flexion becomes easy and all parts of the larynx can be reached without effort.

DR. GEORGE F. CORR, Buffalo: One point which has not been brought out is the matter of tolerance of the larynx in children; how long will it tolerate manipulation? I had a sad experience in this connection: a child had a key in the esophagus for a week. I introduced the esophagoscope but could not find the foreign body, although roentgenoscopy showed where it was. The swelling was so great I could not see it. I worked a half hour and then decided to do a lateral esophagotomy, which I did. It took but a short time and the key was removed, but that night the child suddenly died without any apparent cause. I found out later that another physician had worked on the child for an hour or more by

the indirect method before I saw it. Had I known that, I would not have subjected it to such a continued shock.

DR. A. B. THRASHER, Cincinnati: Dr. Curtis has partially repaid a very old debt which we laryngologists have so long owed to a singing-teacher, E. Garcia, for the discovery of the laryngoscope. Now a laryngologist teaches the proper singing method for the prevention and removal of singers' nodes. I turn these cases over to a singing-teacher with the instructions which Dr. Curtis has given us.

DR. W. B. CHAMBERLIN, Cleveland: Although my early training and instruction was in the indirect method, I have used the direct method almost from its beginning. I am in favor, however, of the indirect method in suitable cases. It is certainly a much less formidable operation than the direct method. I fancy that if any one of us were offered his choice of the methods on himself, he would unquestionably choose the indirect, granting, of course, that it were applicable to the particular case. Not long ago I was able to remove very easily a pedunculated tumor from beneath the cords at the anterior commissure in this way. There is an opinion among men who have been trained in the direct method that the indirect method is difficult. That is not so. It is no more difficult than the methods which the dentist uses every day in his operations on the teeth. Take a wide-mouthed morphin bottle, cover it with dark paper, and on the bottom sketch a larynx, then place a shot or pin in any position and one can practice the indirect method to one's heart's content.

DR. BURT R. SHURLY, Detroit: Those of us who have used the indirect method for many years have a certain amount of sentiment concerning this method, and we sincerely trust that it never will become a lost art. There are a great many things one can do by this method first, and then if not successful one can use the direct method if necessary.

DR. C. G. DWIGHT, Madison, Wis.: The otolaryngologist who lives in a large city knows very little of the disadvantages encountered when the general surgeon has first had the case. Most of my work is in the removal of foreign bodies. I had in one case a Catholic sister who had lodged in her throat a black-headed pin such as they use to fasten their bonnets. The case had been in the hands of a general surgeon three hours before I was called to see it. The pin was lodged straight across and imbedded. Of five different instruments none were powerful enough to detach it because it was so firmly imbedded. I broke two instruments in the attempt. This led me to devise an instrument which is useful for grasping pins of this type. The delicate instruments we have for grasping growths, etc., are very perfect, but we need something stronger to remove these firmly-imbedded things.

DR. HOLBROOK CURTIS, New York: I am glad to see that there are so many advocates of the old method. I agree with

Dr. Freer that we should be expert in both. No laryngologist can afford to neglect the opportunities in which he can use the indirect method. With regard to practicing the indirect method, I have taken an old pin-cushion and put it at the bottom of a three-inch iron tube and then practiced picking the pins out one by one, using a laryngoscope and forceps.

DR. CHEVALIER JACKSON, Pittsburgh: In reply to Dr. Bernstein's question with regard to the removal of a specimen in malignant cases, as Sir Felix Semon pointed out years ago, it is unwise to remove a specimen in any case that, clinically, seems to be malignant unless the patient has consented to immediate operation in the event that the specimen proves malignant. The question should be submitted to the patient beforehand. If he declines external operation, which is the only route in malignancy, then no specimen should be taken. If consent has been obtained, preparation must be made to operate immediately, as soon as we get the report on the frozen section, which we can get now on the same day that the specimen is taken. There is little risk of metastases resulting if operation immediately follows.

DR. ROSS H. SKILLERN, Philadelphia: Dr. Levy spoke of this method not being used in the simple procedures in the larynx, such as making examinations and removing papillomas, under ether. We have tried it without ether and have succeeded. So far as Dr. Mosher is concerned, he is too modest to state that he perfected an instrument of his own and had I seen it first the Killian instrument would not have been in our armamentarium. I had the pleasure of seeing his work, and later the work in the Charité in Berlin, the home of this method, and had I to have the method used on me I should prefer to go to Boston. As to the removal of foreign bodies by this method, we have in the last month removed a number of such bodies and it progressed very nicely, except the last case, a penny in the esophagus. We saw it very beautifully and demonstrated it to several physicians in the room with a great deal of pride, but the pride went just before a fall because when we went after it it went down and down and finally passed into the stomach. Dr. Ridpath spoke of the enucleation of tonsils by this method. In that respect one thing is notable: the remarkably small amount of hemorrhage when this method is used. It is due to pressure on the tongue and some of the vessels that supply the tonsil. As soon as we take the tonsil out the blood seems to start up but is soon controlled. Dr. Freer spoke of the matter of soreness of the throat after the employment of this method. In 100 or 150 cases the children did not complain of any particular soreness. I have asked them frequently. Some of the adults complained of a certain amount of stiffness in the neck. I am not advocating any particular method in every case. We must select the method that is suitable for the case in hand.

VALUE OF ROENTGENOGRAPHY IN DIAG- NOSIS OF DISEASES OF LARYNX AND TRACHEA

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The Roentgen rays have proved to be a great aid to the rhinologist and otologist in the diagnosis of diseases of the accessory cavities of the nose, and in the study of the pathology of the mastoid region. In the field of laryngology, on the other hand, the Roentgen rays have been employed chiefly for the study of the development (ossification) and physiology of the larynx. The very complete atlas issued by Thost¹ of Hamburg in 1913 represents the first systematic attempts to study the pathology of the larynx by means of the Roentgen rays.

PHYSIOLOGY

In the domain of physiology the Roentgen rays have demonstrated some interesting facts concerning certain functions of the larynx. Thus the long-debated question as to whether the cricothyroid muscles act as depressors of the thyroid cartilages or as elevators of the cricoid has been definitely settled in favor of the latter by the studies of Moeller and Fischer.² The various positions assumed by the lips, tongue, soft palate and larynx during phonation have been accurately determined by the beautiful roentgenograms of Scheier.³ More remarkable than these are his⁴ Roentgen studies of deglutition, in which he was able to portray the position of the bismuth mass in the fractional part of a second required for it to pass the larynx.

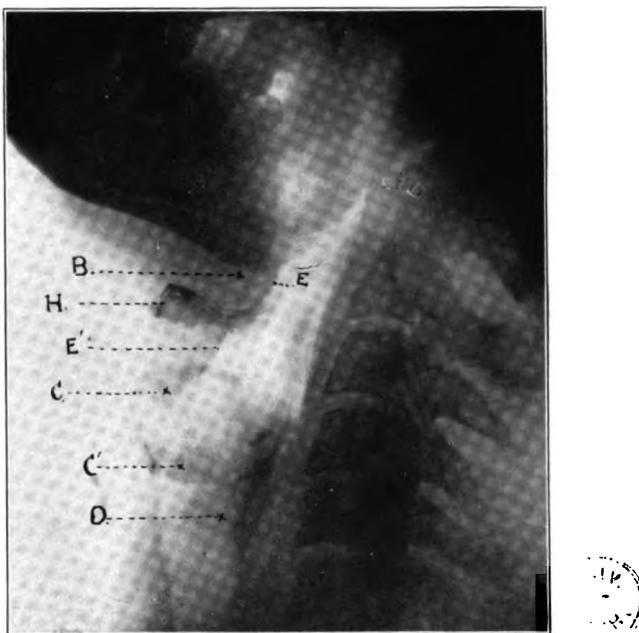


Fig. 1.—Normal larynx of a man, aged 45: *H*, body of hyoid bone. *B*, base of tongue. *E*, *E'*, epiglottis. *C*, *C'*, markedly ossified thyroid cartilage; note the ascending and descending horns of same. *D*, cricoid cartilage. The lumen of the trachea, larynx and pharynx are well delineated.



Fig. 2.—Marked ossification of thyroid cartilage in a man aged 50. Note sharp outline of the epiglottis. Upper arrow rests on the body of the hyoid bone.

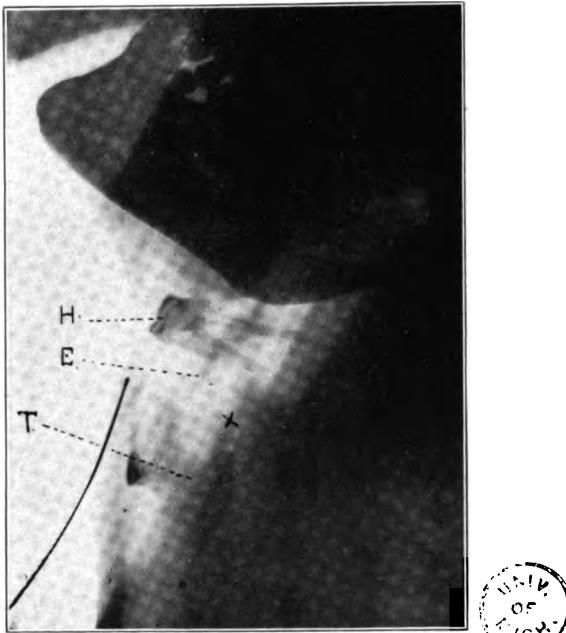


Fig. 3.—Tuberculosis of larynx in a man aged 33, with advanced pulmonary tuberculosis. Subcutaneous tuberculous (?) fistula, containing probe in front of thyroid cartilage. Infiltration of arypepiglottis folds demonstrated at X. Hazy appearance of T, thyroid cartilage, that is, resorption of lime-salts characteristic for laryngeal tuberculosis. Note dense center of ossification in anterior unaffected portion. H, hyoid bone, and E, epiglottis well delineated. Note lumen of larynx and trachea.

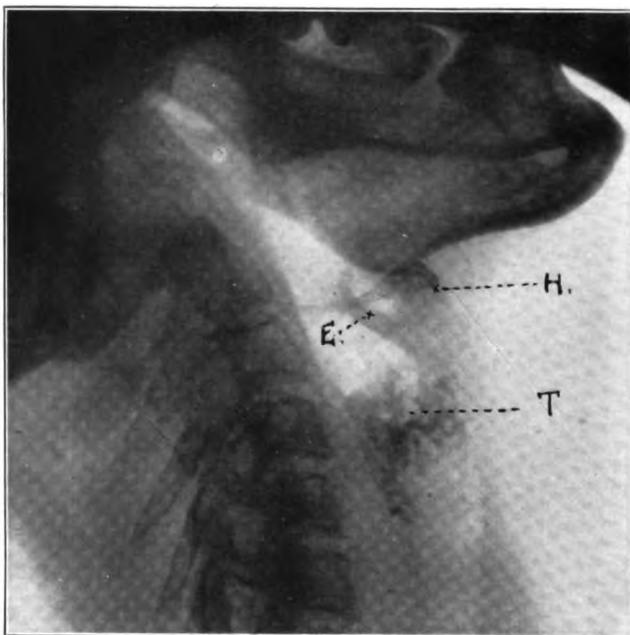


Fig. 4.—Case of carcinoma of hypopharynx in a woman aged 40. The peculiar punched-out appearance of the thyroid cartilage, *T*, is regarded by Thost as characteristic (?) for carcinomatous invasion of the thyroid cartilage from the pharynx (see text). *H*, the hyoid bone, *E*, epiglottis and the laryngotraheal lumen clearly delineated.

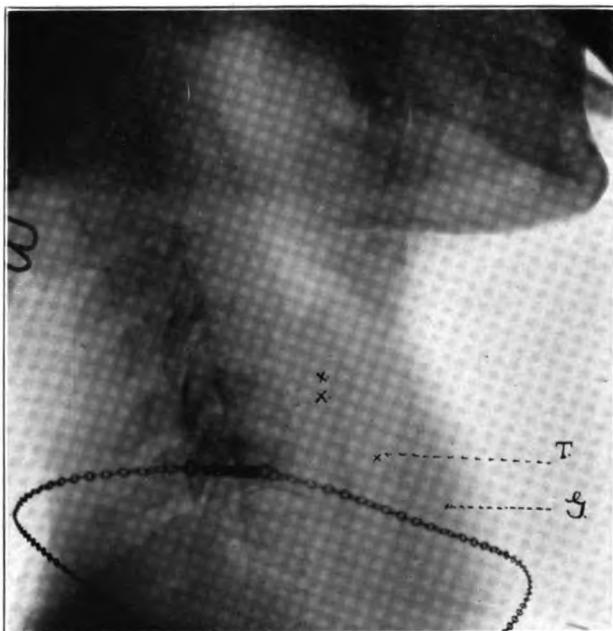


Fig. 5.—*G*, moderate-sized goiter, showing its relation to the trachea *T*, in a girl aged 19. At *X*, *X*, slight ossification in posterior portion of thyroid cartilage. Air-passages delineated by clear zone.

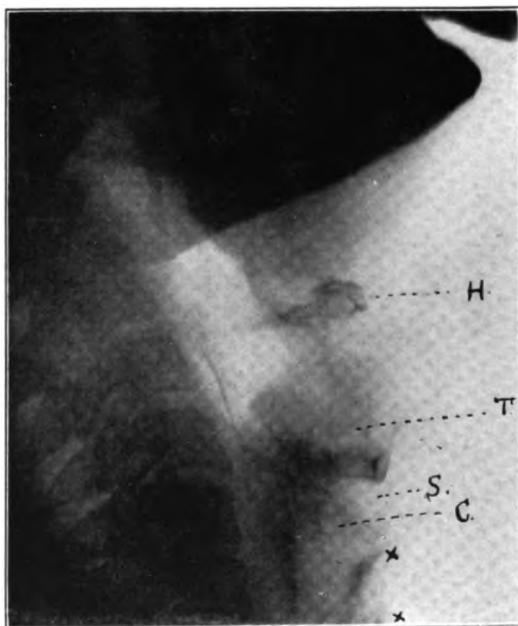


Fig. 6.—Calcified tissue at X , X , encasing a tracheotomy fistula in a patient who has worn a tracheotomy tube for seven years. C , the cricoid cartilage. S , cricothyroid space. T , the ossified thyroid with its inferior and superior horns. H , the hyoid bone, and the epiglottis, are well delineated.



Fig. 7.—Fractured larynx in cadaver of a man aged 69.



According to Thost,¹ roentgenography will demonstrate the well-developed muscular apparatus in the larynges of professional singers.

OSSIFICATION OF THE LARYNX

The Roentgen rays are particularly valuable for the study of the normal process of ossification of the laryngeal cartilages, and in order to appreciate some of the pathologic conditions of the larynx it is important that we should be familiar with the usual course of ossification. According to Scheier⁵ and Fraenkel,⁶ ossification usually begins during the eighteenth or nineteenth year of life, and in both sexes is first noted in the lower part of the posterior border of the thyroid cartilages. From this region it gradually ascends along the posterior border. Ossification then gradually extends forward along the inferior border of the thyroid, giving rise to an L-shaped mass of bone.

In the male, a new center arises at the inferior thyroid notch and another along the superior thyroid border, and by the gradual coalescence of all these centers the cartilage eventually may be completely surrounded by a bony frame (after the fortieth year). See Figs. 1 and 2.

In the female the same process may occasionally occur, but more characteristic for this sex is the freedom from ossification in the anterior portions of the thyroid wings.

An oblique bony line dividing the thyroid into two islands is common in the male, but practically always absent in the female.

In the cricoid the process begins in the seal portion and gradually extends forward into the ring portion of the cartilage.

The arytenoids are next in order and the tracheal rings are among the last to show signs of ossification. Roentgenoscopy has proved that ossification may also occur in the epiglottis.

TECHNIC

Roentgenography of the larynx in the living is easily carried out. The patient sits on a chair or lies on a couch with the plate (8 by 10) in contact with the side of the neck and parallel to the median plane of the body. The patient is instructed to hold his breath and not to swallow during the exposure, which requires about six seconds. A profile picture of the larynx is thus obtained with one side of the larynx superimposed on the other, but the side in contact with the plate comes out very distinctly.

All the roentgenograms which form the basis of this paper were taken for me by Dr. Sidney Lange, to whom I am greatly indebted, and who in another paper, will more fully describe the technic.

THE NORMAL LARYNX IN THE ROENTGENOGRAM

The roentgenogram reveals the following structures (Fig. 1):

The horse-shoe shaped hyoid (*H*) bone and its two processes stand out sharply, as does the base of the tongue (*B*). The epiglottis (*E*) can be seen projecting between the wings of the hyoid bone. The thyroid cartilage (*C, C'*) more or less ossified, is very prominent, while the cricoid (*D*) is covered to some extent by the descending horns of the thyroid. The ventricle of Morgagni is frequently outlined as an oval clearer space in the anterior portion of the thyroid. The arytenoids and aryepiglottic folds and the cricothyroid space can be distinguished. The lumen of the larynx appears distinctly as a lighter area continuous below with the well-defined lumen of the trachea in which the rings, when ossified, stand out distinctly. Before ossification occurs the cartilages are not well delineated, but the air-passages themselves stand out sharply and distinctly in the roentgenogram. (See Fig. 5).

TUBERCULOSIS OF THE LARYNX

Quite characteristic for the roentgenogram of this disease is a peculiar hazy indistinct outline of the

laryngeal cartilages, giving the impression of an over-exposed picture. This type of picture recurs so frequently with the tuberculous larynx that it has great value from a diagnostic point of view. It indicates very clearly that the tuberculous process is not confined to the lining mucosa of the larynx, but that changes occur in the underlying cartilage associated with the resorption of bone. This is distinctly analogous to rarefying changes so frequently noted in roentgenograms of the long bones when the joints are the seat of tuberculous disease. In addition to the changes in the cartilage the infiltration of the soft parts, such as the aryfolds, stand out distinctly. Defects or infiltration of the epiglottis give characteristic pictures.

Roentgenography offers another demonstration of the fact that tuberculous lesions are almost always more extensive than the image in the laryngeal mirror would indicate. (Fig. 3).

SYPHILIS

In contrast to tuberculosis, tertiary syphilis of the larynx is usually associated with a tendency to proliferation rather than to resorption of bone. The roentgenograms in syphilis, therefore, give sharp distinct pictures of the ossified portions of the larynx (Thost). Infiltration or defects in the soft parts may also be made out. In the roentgenogram of a healed case coming under my observation a peculiar cavity, probably due to a former necrosis, is seen above the thyroid cartilage. In another healed case of laryngeal and pharyngeal syphilis associated with the formation of dense cicatrices in the pharynx, the distortion of the lumen of the larynx by cicatricial traction is very well demonstrated.

In doubtful cases, roentgenography should be of considerable value in demonstrating syphilitic perichondritis and in differentiating syphilis from tuberculosis.

CARCINOMA

Carcinoma of the larynx usually occurs in the ossified larynx of the aged, and this tends to obscure intralaryngeal tumors. Nevertheless, a massive tumor can often be made out, and if the lumen be encroached on, the narrowed air-passage can be seen. Tumors of the epiglottis or aryfolds are more readily delineated. In carcinoma of the hypopharynx, with secondary involvement of the larynx, Thost describes roentgenograms with a sieve-like appearance of the thyroid cartilage which he attributes to carcinomatous invasion of the ossified cartilage. Since the same picture may occur in normal larynges, however, and since I have not found it in any of the four intralaryngeal cancers which have been roentgenographed, and but once in three cases of carcinoma of the pharynx, it seems to me that he has overestimated the importance of these findings. (Fig. 4).

STENOSES OF THE LARYNX

In obstruction of the larynx or trachea by foreign bodies, or by tumors or cicatrices within the air-tract, or by compression from without, very interesting roentgenograms can often be obtained. The tumor is often visible and the narrowed lumen appears distinctly.

In one of my cases of papilloma, which required tracheotomy, the roentgenogram shows the entire lumen obliterated above the tracheotomy tube. In a second case of stenosis due to cicatrization following intubation and tracheotomy for diphtheria, the roentgenogram, taken for control, showed a complete restoration of the lumen after treatment.

Roentgenography demonstrates very beautifully the deposits of lime-salts which so frequently occur when the laryngeal or tracheal cartilages have been incised. Thus in a patient who has worn a tracheal cannula for seven years the fistula from the skin to the trachea is completely encased in calcified tissue (Fig. 6).

Considering the difficulties often encountered in examining cases of stenosis by the direct method, a preliminary roentgenogram should often prove to be a great aid to the laryngologist. This is especially true of foreign-body cases, or in cases of aneurysm, goiter or enlarged thymus. (Fig. 5).

RARE DISEASES AND FRACTURES OF THE LARYNX

In addition to the diseases described above, Thost has made interesting Roentgen studies of the gouty larynx and of pemphigus of the larynx. In certain so-called nervous lesions of the throat, he has demonstrated on the bodies of some of the cervical vertebrae new-formed spines and ridges to which he attributes the "nervous" symptoms.

In a limited number of cases, I have fractured the larynges in cadavers and have then had roentgenograms taken. In each instance fracture-lines can be demonstrated (Fig. 7). I hope to be able to report more fully on this particular subject at some future time.

CONCLUSIONS

Satisfactory diagnoses of diseases of the larynx and trachea can usually be made by the ordinary method of examination, but our observations for the most part are limited to a study of the changes in the lining mucous membrane and give no certain information concerning the changes in its underlying and adjacent structures. The Roentgen examination gives additional information concerning the pathologic changes in the underlying cartilages, which are more or less involved whenever the laryngeal mucous membrane is the seat of a chronic disease process, such as tuberculosis or syphilis.

In stenosis or distortion of the lumen of the larynx or the trachea, roentgenography usually reveals the seat, the nature and the extent of the lesion. The knowledge thus gained before operative procedures are undertaken on the larynx is of great value. Roent-

genography also enables us to study the effects of operation and the position of tubes, etc.

Owing to the ease with which it is carried out, the Roentgen method is of a special value in the examination of children or nervous patients.

In concluding I wish to express my appreciation of the kindness of Drs. A. B. Thrasher, S. E. Allen and William Mithoefer in placing some of their patients at my disposal for Roentgen study.

22 West Seventh Street.

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ROENTGENOGRAMS OF THE ACCESSORY SINUSES

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This series of pictures shows some unusual sinus conditions, some illustrations showing the amount of deformity that follows operation on frontal sinuses of different sizes, and a few showing the cosmetic results of Killian's operation of which I unfortunately was unable to have roentgenograms made.

Figures 1 and 2 show the largest frontal sinuses I have ever seen.

The patient, E. H. A., man, aged 20, had sinus disease of indefinite duration. Pain and headache over the frontal sinus were present in January, 1913. Submucous resection was done February 13, giving no relief of the sinus symptoms. At my first examination, Oct. 17, 1914, there were pain, headache and tenderness over both frontals, worse over the right, and there had been paralysis of accommodation for the past year. A thick purulent secretion was being discharged from anterior and posterior nares, especially the right. The septum still deviated superiorly on the right side; half of the middle turbinate remained. There was necrosis about the right frontal duct, pus in both frontals, and the right ethmoidal and sphenoidal sinuses. Intranasal operation was performed, with drainage of frontals, exenteration of right ethmoidals, and removal of wall between posterior ethmoidal and sphenoidal sinuses. Subsequently both frontals were filled with Beck's bismuth paste. November 14 the left frontal was dry, and April 30 the right frontal was dry. Paralysis of accommodation still remains.

Figures 3 and 4 show extremely large frontals.

The patient, S. G., Jan. 21, 1911, gave a history of recurrent coryza. Five weeks previously he had an attack of influenza, which infected the left frontal. There were pain and tenderness over the frontals, with profuse, purulent discharge. Jan. 30, 1911, he had edema of the eyelids. The middle turbi-

nates were removed and saline douches given. March 17 he was still discharging much pus from the frontals. The frontal ducts were enlarged. Saline irrigations of the frontals were instituted and the discharge ceased in four weeks. Plates show extremely large frontals.

Figure 5 shows five frontal sinuses.

Figure 6 was taken in a case of new growth, invading the orbit and ethmoids which also gave symptoms of headaches, vertigo, and deafness; it was probably sarcoma. The sinuses were also discharging large quantities of pus.

Figures 7 and 8 were taken in the following case:

H. A. C., man, aged 31, for six months had been gradually becoming blind. There was double optic neuritis. One year ago he had nasal polyps removed, and at that time complained of pain about the left temple and back of the left eye. At time of examination, July 5, 1911, he could distinguish light, but could not count fingers. Wassermann reaction was negative. There was a firm growth in the region of the left ethmoid. Some pus was obtained on suction. A probe could be passed through the ethmoidal plate into the frontal lobe about one inch; a watery flocculent fluid escaped.

Operation.—The growth was approached by the orbital route; as there was no frontal sinus the space was limited. It was found to be a soft edematous growth in the ethmoidal cells with dural exposure which bulged into nasal cavity with an opening about $\frac{1}{4}$ inch in diameter leading into the brain. Microscopic examination of the tissue confirmed the clinical diagnosis of sarcoma. The man died in January, 1914. Post-mortem revealed an extensive sarcomatous growth in frontal lobes.

H. T. (Fig. 9) has had sinus disease for fifteen years and has had three external operations. His chief symptoms are intense neuralgia, lasting from two to three hours daily, localizing at inner canthus and occiput, and some thick mucopurulent secretion. The interesting thing about Figure 9 is that it apparently shows some ethmoidal cells with thickened membrane or secretion, though they have all been removed. On opening the region again, I found that the ethmoidal cells had been entirely extirpated and only one small pocket, containing a couple of drops of pus between the fibrous tissue and the bone. The pain was due to neuralgia of Meckel's ganglion.

Figure 10 shows unilateral frontal and ethmoidal disease with probe in frontal.

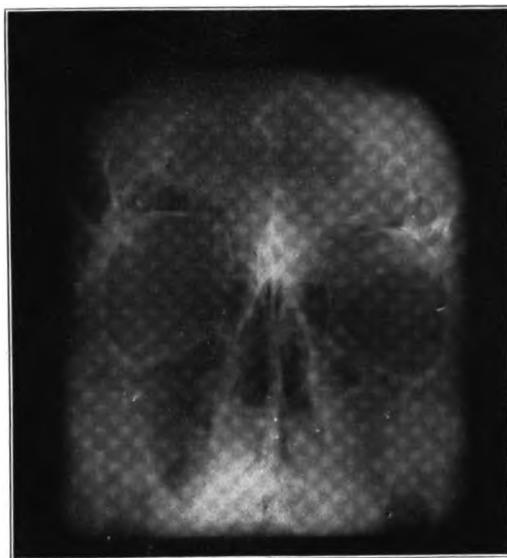


Figure 1.



Figure 2.





Figure 3.

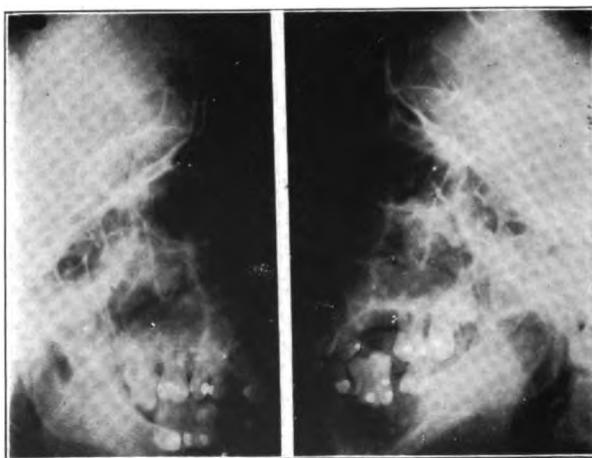


Figure 4.

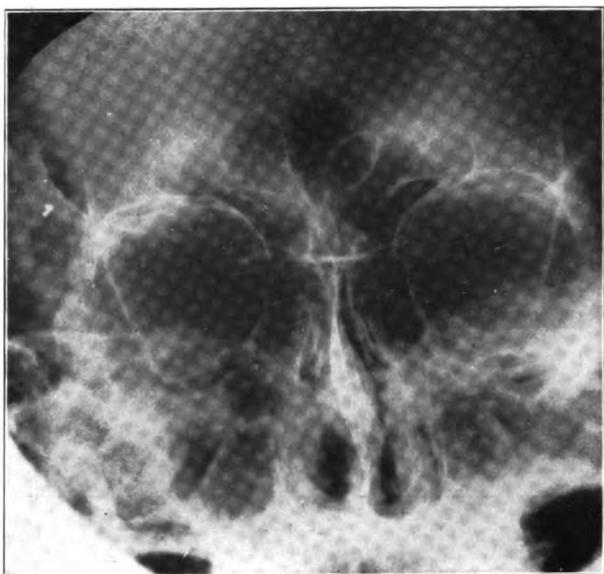


Figure 5.



Figure 6.



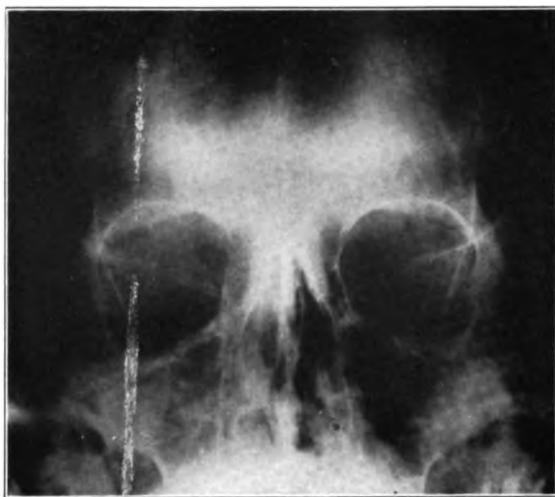


Figure 7.



Figure 8.



Figure 9.



Figure 10.





Figure 11.



Figure 12.



Figure 13.



Figure 14.





Figure 15.



Figure 16.

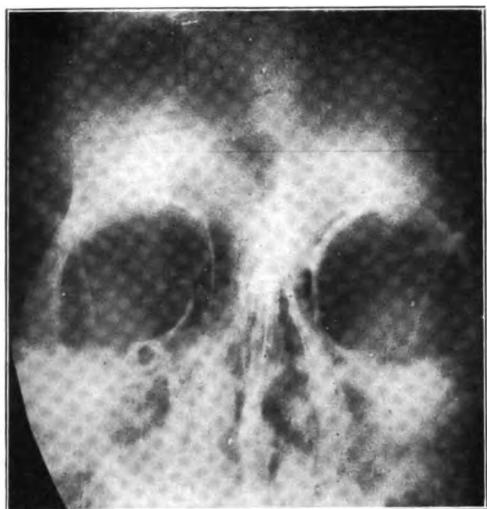


Figure 17.

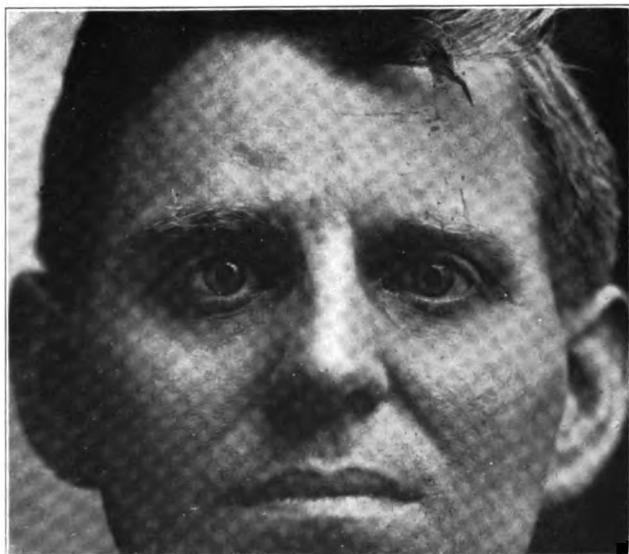


Figure 18.



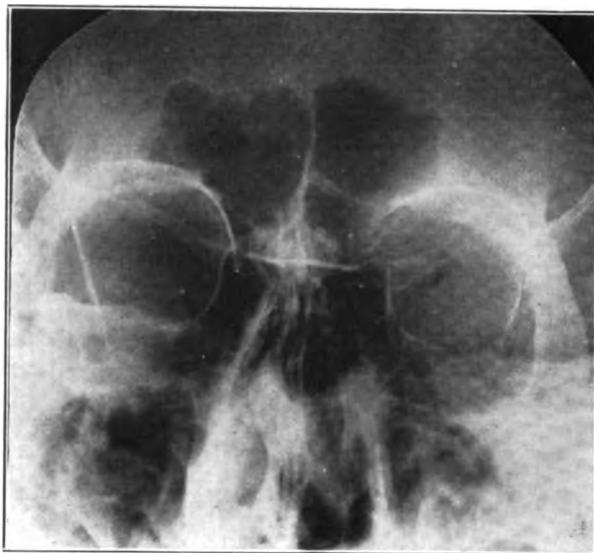


Figure 19.

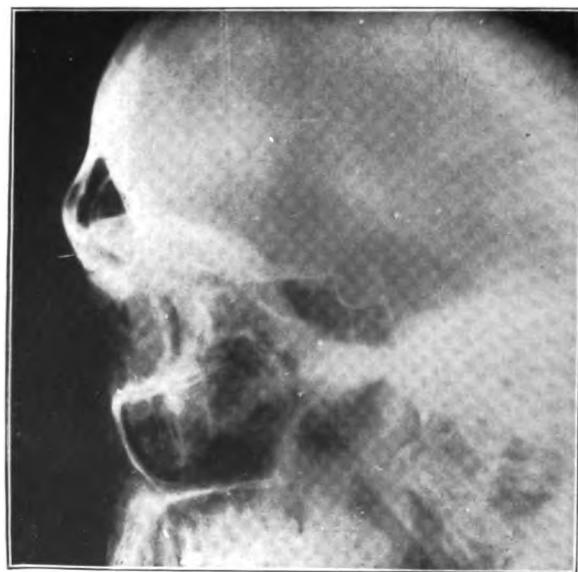


Figure 20.



Figure 21.

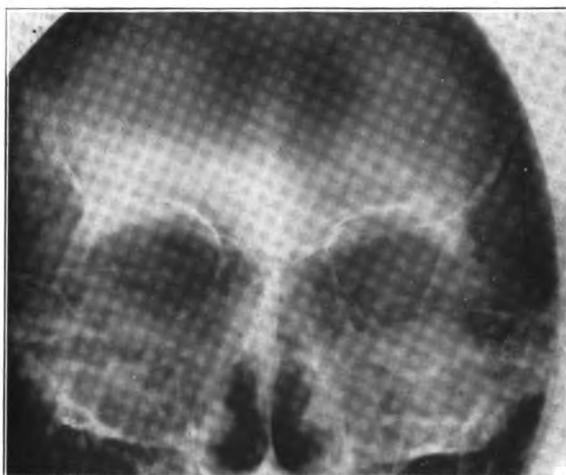


Figure 22.





Figure 23.



Figure 24.

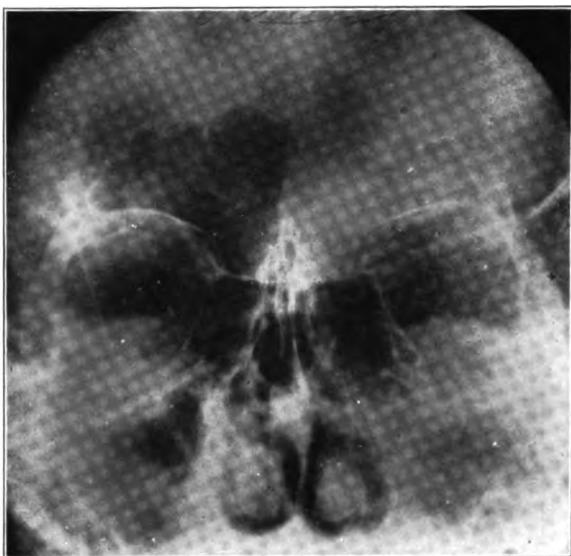


Figure 25.

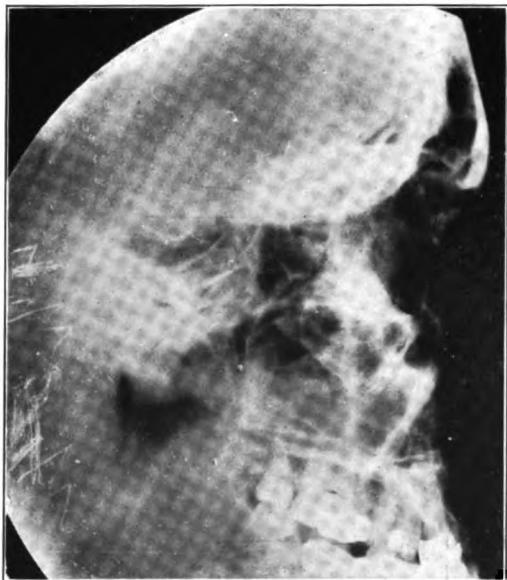


Figure 26.





Figure 27.



Figure 28.



Figure 29.



Figure 30.





Figure 31.



Figure 32.



Figure 33.



Figure 34.





Figure 35.



Figure 36.

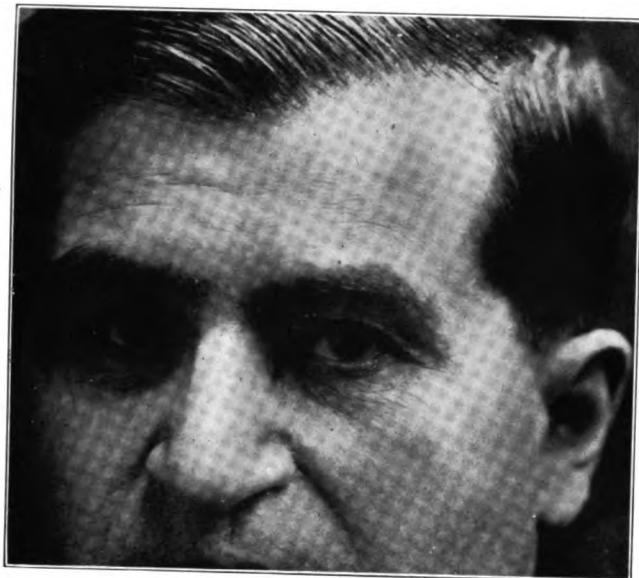


Figure 37.



Figure 38.



Figure 11 was taken in a case of atrophic rhinitis with sphenoidal disease and double optic neuritis. The plate, made after the operation, shows absence of frontal sinus and area removed in exenteration of ethmoidals and opening of the sphenoidal sinuses. Figure 12 shows cosmetic results after operation on this patient.

Figure 13 shows large left frontal, containing thickened membrane and pus. Slight changes in left ethmoidals and antrum. Figure 14 shows cosmetic results of the Killian operation in this case.

Figure 15 reveals small frontal, left, absent on right side. All sinuses infected. For some reasons unknown to me, pyogenic membrane continues to be firm in the ethmoidal region, which secretes considerable pus. The right frontal region has been opened four times and each time softened bone was found, though the Wassermann reaction was negative. Mixed treatment was given for some months without effect. Figure 16 shows cosmetic results of operation.

Figure 17 shows chronic infective process of right frontal sinus. History of polyp removed for relief of asthma nine years ago. Asthma recurred three years ago. Examination shows polypoid degeneration of ethmoidal labyrinth. Pain, headaches, and tenderness over right frontal sinus. Killian operation on right side, frontal, ethmoidal and sphenoidal sinuses. Intranasal operation on same sinuses left side. Resulted well. Figure 18 shows cosmetic results of the Killian operation in this case.

Figure 19 shows an interesting condition of one frontal sinus above another with a very small aperture between them, in a case with a history of recurrent attacks of acute frontal sinusitis on the right side for five years. The plate does not show much change in the sinuses except the right antrum, which was nearly filled with pyogenic membrane. At the time of the operation, there was a considerable amount of thick mucus on the floor of the upper sinus. Figure 20 is a transverse view of Figure 19. Figure 21

shows cosmetic results of the Killian operation in this case.

Figure 22 shows all the sinuses involved. Examination revealed pus in frontals, ethmoidals, sphenoidals and antral sinuses with polypoid degeneration of ethmoidal mucosa. Figure 23 shows transverse view of Figure 22. Figure 24 shows the cosmetic result. Left side, Killian operation; right side, the open method. Note the striking deformity compared with the Killian method.

Figure 25 reveals a large chronically infected right frontal sinus. The left frontal sinus is perfectly normal. Figure 26 is a transverse view of Figure 25. Figure 27 shows cosmetic results after the Killian operation. Figure 28 shows the result one year later after filling in depression with paraffin.

Figure 29 shows large frontals, three in number, in a case with history of sinus disease, over eighteen months. Some ethmoidal cells had been primarily removed which is seen in the plate. Antra involved. History of Vincent's spirillum and bacilli having been found, but I could not find them, seeing only the usual mixed infection, fistula at external end of the frontal sinus. Operation revealed much softened bone in that region and the orbital plates of the ethmoidal bone softened and perforated. One frontal duct led into left nose, two frontal ducts into right nose. Part of bony orbit gone on the left side. Antra contained pus and very thick membrane. Figure 30 shows transverse view of Figure 29. The sphenoidal sinuses would give the impression of not being involved, but they contain pus and considerable thickening of the mucosa. Figure 31 shows the cosmetic results of the double Killian operation. The incision was in the eyebrow down each side of the nose, and then joined across root of the nose. All sinuses were cleared out in one operation.

Figure 32 reveals involvement of all of the sinuses, though the ethmoidals had been fairly well removed before the plate was made. Note spot in the right

frontal sinus caused by bismuth paste. Operation revealed sinuses nearly filled with thickened membrane and foul pus. Figure 33 shows the cosmetic result of the double Killian operation, same incision as in the preceding case. All sinuses were cleared out in one operation.

Figure 34 shows cosmetic result. Patient had dacryocystitis and optic atrophy; vision lost in that eye with perforation of orbital ethmoidal plate; orbital tissues infected; much swelling and protrusion of globe. Two incisions were made, one below the eyebrow, curving down nose, the other in the upper border of eyebrow. Convalescence was complicated on account of erysipelas.

Figure 35 shows result of Killian operation on left side in 1906, for acute exacerbation of frontal disease. There had been intense pain with temperature 105. Two years later, right frontal became infected and necrosed through median wall, infecting the area of the previous operation on the left side. Abscess opened through the old incision. Two weeks later, right frontal sinus cleaned out through usual incision, removing the bony floor of the sinus, and from the left side through the median partition, leaving the anterior wall.

Figure 36 shows the cosmetic results of the Killian operation, left side. Figure 37 shows cosmetic result after exenteration of all the sinuses except right frontal, and all of the nasal mucosa except vestibule for adenocarcinoma. Incision divided, upper tip in median line, then running upward at junction of the nose and the cheek and through the eyebrow.

Figure 38 shows cosmetic result in double Killian operation.

15 East Forty-Eighth Street.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRs. IGLAER AND HURD

DR. G. E. PFAHLER, Philadelphia: The more or less new work done by Dr. Iglauer in the diagnosis of disease in

the larynx opens up a new field in which I am sure we will make progress. We have all seen these things, but most of us have failed to interpret them properly, but with this aid we will certainly make rapid advances in this respect. I have not made much attempt to diagnose diseases of the larynx. In my studies of the larynx and neck I have seen some of these changes but did not interpret them properly. I was rather disappointed that in many of the cases presented by Dr. Hurd he did not refer to the disease shown in the sphenoid by the anteroposterior view. Dr. Skillern and I presented a paper on this subject three years ago and the more I use the method and the more I study these sinuses, the more I am convinced of the value of this work. The two sphenoid outlines can be compared directly and if looked at as a whole one stands out more clearly than the other and the definite outline of the sphenoid can be noted in nearly every one of the plates. We should be just as careful in interpreting the sphenoid sinuses as the others.

DR. P. M. HICKEY, Detroit: The work that has been shown this morning in the differentiation of soft tissue details would be accentuated by the recent improvements which are coming out in the ability of the roentgenologist to control the performance of his tubes. We have been missing the soft tissue details because we have not been able to control accurately the performance of the tube. We have used the three gradations, hard, medium and soft, with no exact means of differentiation. The late improvements which some of the roentgenologists have placed at our disposal, in getting exact regulation of the tubes for soft tissue details, will enable us to make greater progress along this line. One thing about the trachea is the importance of the outline in the anteroposterior position, with the plate against the chest, of substernal thyroid, where perhaps there is no visible tumor on the outside, and yet where compression of the trachea can be beautifully demonstrated on the plate.

DR. E. W. CALDWELL, New York: Will Dr. Iglauer explain again the difference between the calcification of the larynx alleged to be characteristic of syphilis, and that which is alleged to be characteristic of carcinoma? Also does he think that calcification or ossification in the larynx is essentially different from the same process in other cartilages, such as the costal cartilages? Has he observed that the degree of calcification of the larynx bears any relation to the amount of calcification of other cartilages in the same individual?

DR. MARK D. STEVENSON, Akron, Ohio: I recently had a case of marked stenosis of the larynx which necessitated immediate tracheotomy. The roentgenograms showed conclusively that it was a case of acromegaly. The pictures dem-

onstrated ossification of the larynx and the condition of the pituitary body.

DR. G. C. JOHNSTON, Pittsburgh: I had the pleasure of examining the patient just referred to by Dr. Stevenson, a case of acromegaly, and the examination of the larynx was interesting. I had not previously associated these cases of acromegaly with involvement of the larynx at all. The patient had the typical gingerbread-man hands and characteristic features. Not long ago in investigating some pituitaries, we found one that was ideal for the Cushing operation, having all the indications. The surgeon went in to perform submucous resection and just when he was completing that and was about to enter the sphenoid there was a gush of pus which was a contra-indication for going further. The lesson is not to look too much in one place. We failed to see the evidence of necrosis in the hard palate. We must be looking for trouble all the time or we will find it without looking for it.

DR. A. I. WEIL, New Orleans: I have had little experience with roentgenograms of the larynx except one case in which its use was shown, that of a man who had had ossification of the arytenoids which had sloughed out, so that he coughed up one complete arytenoid, and later the other. He brought the specimens to me and when we looked into the larynx there was sinking of the arytenoid region, but we could not have told to what it was owing if we had not seen these specimens. With the roentgenogram, although the picture was hazy, it was easy to see the absence of the arytenoids. Without that it would have been impossible to state the condition that had preceded his presenting himself for treatment. I have used the Roentgen ray in bone lesions in retropharyngeal abscess on several occasions, and find it a very valuable aid to examination with the probe. It outlines very clearly the cavity and aids in the treatment.

DR. HARRIS P. MOSHER, Boston: These papers teach that we should take more radiograms of the larynx and endeavor to learn to interpret them properly. I had a rather embarrassing and somewhat humorous case of a retired manufacturer who had taken up farming. He was building a chicken coop and had a lot of staples in his mouth, and thought that he had swallowed one. Sometime later he had some disturbance and went to a general physician who took a roentgenogram and told him the staple was there, and brought the patient down for me to see. On looking at the roentgenogram I was a bit suspicious; I examined the man by the direct method, and was still more suspicious. I sent him for another picture and found that what had shown in the first picture was nothing more nor less than the hyoid bone.

DR. GEORGE F. COTT, Buffalo: All laryngologists acknowledge the value of roentgenograms but the average cases that

the practitioner sees are not the ones shown. When there is considerable thickening in the larynx it shows, but when there is a rarefying condition the Roentgen ray shows nothing, and they are the cases that the average practitioner sees.

DR. L. E. LEWALD, New York: I had two cases of retropharyngeal abscess that we were able to differentiate successfully in children. A physician who saw one of the cases was of the opinion that it was tuberculosis of the cervical vertebrae, with probably abscess of that origin, which would preclude opening the abscess in the pharynx. Roentgenoscopy disclosed not only absence of any bone lesion in the vertebrae but also, very distinctly, the outlines of an abscess in the pharynx, and it was opened successfully. Another patient in whom there was swelling in the pharynx, associated with tuberculosis of the cervical lymph-nodes, showed an outline in the pharynx sufficiently well to warrant incision. One other case of interest was that of a supposed tumor, as carcinoma of the upper end of the esophagus, in which the Roentgen ray enabled us to exclude a tumor and make a diagnosis, when taken together with other symptoms, of glossolabiolaryngeal paralysis.

DR. SAMUEL IGLAVER, Cincinnati: Dr. Hickey referred to pictures of the trachea. I did not go into that subject much because it has been worked out pretty well by the roentgenologist. I have a picture, however, which shows a kink in the trachea due to pleuritic adhesions pulling it out of line. In compression of the trachea by a thyroid tumor, it is, of course, necessary to have anteroposterior pictures. Dr. Caldwell asks about calcification and ossification in the larynx. It is difficult to reduce the matter to rules, but I think according to the work of Fraenkel and Scheier, that it begins at about the age of 19. Sometimes you find it at 14 or 15 years, but you may find a woman as old as 100 without any distinct ossification in the anterior portions of the thyroid cartilage. Calcification usually precedes ossification. I mentioned the relation of the vertebrae to laryngeal conditions. With an abscess in the retropharynx, it is very important to study the condition of the vertebrae. I have had no experience with acromegaly and am interested in the report made by Dr. Stevenson and Dr. Johnston. With regard to Dr. Weil's case, some studies have been made on the question of dislocation of the arytenoid cartilages, and it has been possible to diagnose the condition by the Roentgen ray. As to Dr. Mosher's case, it is easy to understand how that mistake could be made, as the hyoid bone would have the appearance and shape of a staple. Just the reverse of his experience occurred to me. A patient was brought to me with the statement that roentgenogram had shown no foreign body, but I had another taken which revealed a safety pin which had been in the larynx for six months.

PAPILLOMA OF THE LARYNX

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ETIOLOGY AND HISTOLOGY

Many papillomas spring from an inflammatory, syphilitic, tuberculous or even a malignant base, and histologically the malignant are but an exaggerated and continued form of the benign papilloma. A beginning hyperplasia on the vocal cord, irrespective of its underlying cause, may in due course of time assume proportions, varying from a small papular mound to a mass of epithelial growth filling the entire larynx. The proliferation in all cases is chiefly that of the epithelium, although there will be found fibrous thickenings occupying largely the posterior laryngeal wall and the posterior half of the vocal cords, which are seen quite frequently in habitual consumers of alcoholic beverages, also in newsboys, peddlers, hawkers and in those suffering from chronic or atrophic rhinitis. In singers, particularly those with soprano or tenor voices, these thickenings of the epithelium occur on the anterior third of the cord, and are the result possibly of muscle strain. From these hyperplasias spring pointed projections, which form the so-called papilloma. The surface may be papillary or may be smooth with but slight irregularities. The color may vary from a pale, dead white to a red or rose color; sometimes they are dark gray, at others the same color as the cord. Often they are mistaken for singers' nodules, particularly when located at the anterior third of the cord on its border; they may be single, broad-based, multiple or pedunculated with slender bases and vibrate with the respiratory current. They occur frequently in children as a mass filling the larynx, crowding one on the other,

some with broad bases and others with pedunculated bases. The simple flat papilloma has but few branching projections, usually very white, with a surface cornification such as is seen in the hard, dry wart on the hand.

This type is observed in elderly men and should be regarded with suspicion, particularly if there is increased vascularity at the base. Often the microscope will reveal no indication of malignancy, as the bits of epithelium removed from the surface of the growth give no evidence of the character of the substratum; but later examination will define the malignant character of the underlying structure.

The frequency of papilloma as compared to other benign growths varies from 39 to 50 per cent. of all cases of benign laryngeal growths. When appearing singly, their most frequent locality is in the anterior half, while the multiple variety will be found most frequently in the posterior part of the larynx, but may also extend to the rest of the mucosa. In children, papilloma is the most frequent laryngeal growth and has been known to be congenital. Here they appear in the branching or budding form and may spring from the entire laryngeal mucosa. In the greater number of instances they reappear persistently when removed until such physiologic change takes place in the child as will occasion their permanent disappearance.

SYMPTOMS

A small papilloma may exist on the vocal cord of an adult for a long time without attracting the attention of the individual or his associates, either by local discomfort or alteration in voice. In fact, singers have been able to continue their professional work with a moderate-sized papilloma on the cord, without noticeable alteration, except perchance a failure to produce properly one particular note in the limits of their vocal register. In the majority of instances, however, the most noticeable symptom of the existence of papilloma of the larynx is a husky voice or some deviation

from the normal. Hoarseness, with now and then a falsetto note, or the reduction of the voice to a subdued whisper is most marked in the adult. The single papilloma when situated on the anterior third of the cord will produce considerably more vocal disturbance than when situated elsewhere. In the multiple variety, particularly in children, the voice is often reduced to a low, hoarse whisper and the cry of the infant, when multiple papillomas are present, resembles that squeaky sound often noted in cases of croup or acute edema of the larynx. The child is often dyspneic and under exercise may become cyanotic. During excitement the facial expression assumes a peculiar aspect denoting insufficient respiration. The same condition is often seen in children in whom large lymphoid masses exist both at the base of the tongue and in the nasopharynx, but when hoarseness has been a prevalent symptom in the child over a continued period, although tonsils and adenoids are sufficiently hypertrophied to warrant the supposition that they are responsible for the hoarseness, it is nevertheless advisable to bear in mind the possible existence of papilloma. In children the long continued presence of papilloma causes irritability, impairs digestion, narrows the chest by insufficient respiration and incidentally reduces the vitality owing to improper oxygenation of the blood. They become pale, anemic and emaciated, although exceptions to this rule are often seen, when the child is fat, thick-necked and of good color.

FREQUENCY

Judging from the reports formerly submitted by Fauvel and others, we can reasonably conclude that in the early history of laryngology more of these neoplasms existed than at present. The reason for this lessening in frequency may be attributed, according to Wright to two causes:

First, the number of trifling laryngeal complaints which come under the observation of the laryngologist to-day has enormously increased; second, to-day treatment in these

cases, but especially early and judicious treatment of nasal and pharyngeal diseases has greatly cut down the liability to inflammatory benign laryngeal neoplasms.

Their occurrence in children is comparatively rare. Clark found only twelve cases in the examination of 12,623 children under 14 years of age at the Massachusetts General Hospital. Over a period of fifteen years there have come under my care and treatment at the Manhattan Eye, Ear and Throat Hospital only eight cases, and I have had occasion to observe in the clinics of my confrères only a few additional ones. In 300 tumors of the larynx reported by Fauvel, 206 were papillomas, and of this number nine were in children under the age of 15 years. In the reports of 302 cases of combined papilloma and fibroma of the larynx, 209 occurred in men and 93 in women, thus showing a preponderating tendency of this growth in men.

TREATMENT

Laryngofissure was at one time believed to be effective in the removal of these growths and in the prevention of their recurrence, but the experience of many operators has demonstrated that this is not only ineffective in the majority of instances, but permanently injures the voice, so that it is now deemed an absolutely unjustifiable procedure. Abbey reports a case in which thyrotomy was performed four times, with recurrence of the growth after each operation, although the bases of the tumors were cauterized; tracheotomy had finally to be done ere the condition was overcome. Lindon reports a case in which thyrotomy was performed seventeen times; but the case finally resulted in laryngeal stenosis, necessitating permanent use of the tracheal tube. In adults, removal of the growth either by indirect or direct laryngoscopy offers fair hope of its eradication, although in many instances recurrence takes place even though the base is cauterized. In the multiple variety in children, surgical removal by direct methods not only results

in recurrence of the growth at the site of operation, but likewise occasions new growths to spring up on adjacent mucosa, even on the epiglottis, aryepiglottic folds and trachea. Occasionally in children the growths may be removed by the direct method and the bases fulgurated, and the operator be able to keep ahead of the recurrence of the growths until such physiologic change takes place as will result in their permanent disappearance. In this way the necessity for a tracheotomy-tube may be obviated. Fulguration will result in the disappearance temporarily of the growth, and the recurrence is postponed longer than when operative measures alone are employed; but fulguration has been disappointing as a permanent and positive relief for these growths in children. About the time of puberty or in adults the tendency to recurrence is markedly less, and removal either by fulguration or instrumentation presents more favorable prognosis as regards recurrence. To apply the fulgurating spark with sufficient intensity to be effective it is necessary to have the cauterizing point well insulated to prevent short-circuiting with the metal laryngeal spatula. It is also necessary to have the larynx as free from secretions as possible, as the wet mucous surface tends to disseminate the spark so that its concentration on the growth itself is ineffective. It is also necessary to bear in mind that ether and chloroform fumes are highly inflammable and the child should be permitted to breathe for a half minute at least after the anesthesia is removed ere the fulgurating spark is applied.

In some of my cases I have been able to apply the fulgurating spark with cocaine anesthesia alone and I believe this to be the better method if the child is at all tractable. The fulgurating tip should be placed directly on the wart before the spark is turned on and also the current shut off before the point is removed; otherwise the current will be transmitted to the metallic speculum. When a proper spark has been obtained

in the larynx the transmission of light may be seen externally, and a good illumination is observable simulating that of transillumination of the sinuses. Unless fulguration is excessive no edema or other untoward symptoms result, and the larynx may be entirely cleared of its neoplasms at one sitting, provided the secretions and the tractability of the child permit its continuance. In one or two instances, however, I have seen considerable edema follow fulguration. In one case (Case 3), particularly, the larynx began to swell almost immediately after the application of the spark, but in this instance my associate, Dr. MacPherson, desired to be very thorough as the parents wished to remove the child to another city, and we hoped to get rid of the growths entirely by the one application. The edema following the fulguration was so threatening that it was deemed advisable to do a tracheotomy. In the other cases, however, there were no indications of dyspnea, cyanosis or any evidence of pain on the part of the patients. The best surgical method for these cases and the one method which is most invaluable in meeting the requirements of multiple papilloma in children is tracheotomy. This was recommended years ago by Hunter Mackenzie, and with the exception of a few cases has proved a most efficient therapeutic measure.

Tracheotomy, *per se*, is virtually without danger, particularly if all surgical precautions are employed and the child is placed under a croup tent for a few days subsequent to the operation. It is necessary for the child to wear this tube for a period varying from six months to two years, depending largely on the age of the patient and the time necessary for the physiologic change to take place, which eventuates in the disappearance of the growths. I have seen one case in which marked fibrosis resulted from the frequent removal of a single papilloma in the anterior commissure of the larynx, and from the anterior border of this fibrosis a large single papilloma projected out between the vocal cords. This case had been under

observation for a long period of years, but both fibrosis and papilloma disappeared between one visit to the clinic and the next, a period of about two weeks. It demonstrated beyond question the conclusions advanced by Dr. Jonathan Wright a few years previously, based on observations of the same case, that a physiologic change would at some time occur when this growth would disappear. In accordance with his prognosis, not only the papilloma but the fibrosis disappeared within a period of a month, so that the voice became almost normal.

RADIUM

Radium has been applied in a number of instances, and in some cases marvelous results have been obtained. Abbey reports a case in which the application of 100 mg. of radium kept in position for one-half hour resulted in the rapid disappearance of the growth. Similar experiences have been related by Harris and Culbert. In my experience, however, there is one case presenting sufficient interest to warrant a detailed account, not yielding to radium.

CASE 1.—A. V., aged 15, had from birth a husky voice, leading to the supposition that there were congenital growths in the larynx. When about 5 years of age he was operated on by Dr. Culbert for multiple laryngeal papilloma associated with the characteristic symptoms. Laryngofissure was performed at that time and the entire contents of the larynx cleaned out and the mucosa was cauterized. Within two weeks there was noticeable improvement, which improvement lasted for about six years. At the end of that time there began a recurrence of the symptoms such as hoarseness, dyspnea and imperfect voice production. As this continued to increase he came to my clinic at the Manhattan Eye, Ear and Throat Hospital, Sept. 19, 1911, at which time there could be seen a number of warts on both sides of the larynx, both anteriorly and posteriorly. The voice was very imperfect and of a hoarse, whispering character. The evidence of the former laryngofissure was observable and the movement of the larynx was somewhat imperfect. A tracheotomy was performed and the tube worn for the space of nearly a year. The growths were removed under cocaine anesthesia by the direct method, it being reasonable to suppose that surgical removal at this stage, when the patient was approaching puberty, might result in a permanent eradication. They

recurred with regular frequency. It was later determined, April 23, 1912, that fulguration should be tried without surgical interference. The growths disappeared following the fulguration and the necessity for another seance did not occur for a period of three months, when they were again removed in the same manner. They recurred again at the end of two months, when the third application was made. This time they recurred at the end of a month. After each fulguration, however, a less number of growths returned and the right side of the larynx cleared up almost entirely. The persistent fibrosis together with a large sessile papilloma remained on the left vocal cord and ventricular band. The obstruction to laryngeal respiration, however, was so slight that the tracheotomy-tube was removed in October, 1912, since which time local treatment and rest together with partial removal of the growth, whenever it encroached on the larynx, has followed. This procedure was carried out in the belief that the boy was approaching that physiologic change incident to puberty which would result in a permanent disappearance.

Radium Treatment.—As this did not take place it was decided in March to employ radium. Through the kindness of Dr. Wolf Freudenthal a tube of radium was placed in the larynx after cocainization, March 19, 1914, and left in for about three-quarters of an hour. There appeared to be a disappearance of some of the thickening around the growth.

March 26, it was again applied for a period of about one-half hour following which there seemed to be a marked reaction. The voice has improved under the application of the radium, but the growth continues to recur. There have been three additional applications of radium, varying from fifteen minutes to three-quarters of an hour, but so far as clinical observation goes there has been no diminution in the size of the growth. The boy is in good health, speaks with a hoarse voice, and while the radium has apparently had little or no effect on it, my belief still holds that physiologic change will ultimately bring about that which therapeutic measures have failed to accomplish.

Delavan suggested years ago the employment of alcohol locally applied for the cure of papilloma of the larynx, and in many instances it has proved effective. I have applied it in a number of cases of papilloma of the larynx in children without any apparent effect, but here their multiplicity and the large area of mucosal involvement naturally lessen its effectiveness. In adults, the conditions are entirely different and the shrinking and drying properties of alcohol tend to

bleach and dry the superficial epithelial surface so that it might disappear by autoclysis as the tonsil does with increasing age.

Shurly has recommended the employment of *Thuja-occidentalis* locally and internally. This also failed in my cases of multiple papilloma of the larynx in children. Castor oil, sodium salicylate, zinc chlorid, silver nitrate, iodin and various other therapeutic agents I have tried persistently, but without any apparent effect. In my first series of cases, reported some years ago, the last case of the series had been persistent in the return of the warts when removed by the direct method and had not responded to tracheotomy, although the tube had been worn over a year. One application of the fulgurating spark resulted in their immediate disappearance, from which I concluded that fulguration would be the solution to the problem. Subsequent experience, however, has disabused my mind of this hope as by fulguration the growths can be immediately and effectively removed; but they return with the same regularity as when removed by surgical means, although the length of time intermediate between the destruction of the growth and its reappearance is longer.

From the fact that in some instances of multiple papilloma of the larynx removal will result not only in the reappearance of these growths in their former situation, but likewise on adjacent mucous membranes, it has occurred to me that there might be an infectivity embodied in certain of these growths, in which, if an emulsion were made of the growth itself, hypodermic injection might prove beneficial in their complete eradication. Since giving expression to these ideas on several occasions no case has presented itself in which a sufficient quantity of the growths could be obtained for this purpose. It is a well-known fact, however, that not only laryngeal warts but skin warts will reproduce themselves on abraded skin or mucous surfaces in some instances and not in others.

SEQUELS

Barring the few unfortunate instances in which wearing the tracheotomy-tube over long periods of years has not eventuated in the disappearance of the papilloma, the prognosis is favorable to their disappearance. The voice, however, in the majority of instances is altered in some degree and probably in children in whom multiple papillomas have existed it may never attain perfection thereafter. In isolated, pedunculated papilloma on the vocal cords of the adult removal is ordinarily followed by complete restoration of voice. When the tracheal tube has been worn for a year or more the cartilaginous rings lose their elasticity and on the withdrawal of the tracheotomy-tube the trachea collapses on inspiration. This may be largely obviated by frequent withdrawals of the tube during the course of the treatment, so that the tracheal rings may expand and contract during the respiratory act. When the time has arrived for the permanent withdrawal of the tube it is often advisable to insert tubes diminishing in size until the minimum-sized tube has been reached, after which time it is sometimes necessary to insert a rubber catheter until the larynx and subglottic structures have resumed their normal resiliency. A straight tracheal tube, with just sufficient flange at the end to hold it within the tracheal incision, is often better than one which is curved and extends far down into the lumen of the trachea, for in this way the thickening incident to friction against the tracheal mucosa is obviated. In cases of multiple papilloma in children after tracheotomy has been performed, close observation will reveal these growths extending into the upper part of the tracheal wound and impinging against the tube. I have seen the entire space between the tracheal wound and the larynx almost completely filled with these growths following operations on the laryngeal neoplasms. Occasionally there will result the necessity for a plastic operation

to close the tracheal wound completely, but in the majority of instances the withdrawal of the tube will be followed by the wound closing by granulation.

REPORT OF CASES

CASE 2.—An Italian boy, aged 7, presented himself at my clinic in 1909 complaining of hoarseness from birth. Examination of the larynx revealed multiple papillomas. One of the papillomas was removed for microscopic examination, and a syphilitic base was revealed. One injection of salvarsan resulted in the complete disappearance of all the growths, within about three weeks time. The voice was not restored, but was markedly improved from a hoarse whispering voice to a hoarse loud voice. About two months after the injection of salvarsan the boy was brought to the clinic suffering from pronounced jaundice, which did not respond to treatment. His condition became worse until he died about three weeks after observation. No necropsy was permitted. Treatment for his inherited syphilis was instituted at a time when large single doses of salvarsan were being administered, and I have often wondered if repeated smaller doses would not have resulted in the same favorable outcome to the laryngeal condition and possibly obviated the liver complication.

CASE 3.—J. S., a boy, aged 3½ years, was admitted to the clinic June 27, 1912. He had complained of hoarseness with whispering voice dating back eighteen months. He had frequent attacks of dyspnea and at all times suffered from difficult respiration. His health was otherwise good. No specific history was obtainable. Examination of the larynx revealed multiple papillomas on both vocal cords and extending from the anterior commissure to the arytenoids. The color was that of the mucous membrane. July 11, fulguration was applied by the use of the Jackson speculum under chloroform anesthesia. Repeated applications of the fulgurating spark were made, July 18, August 1 and 15, and September 5 and 12. After each of these fulgurations the larynx would remain clear of laryngeal warts for a short space when they would recur. On the whole, the larynx showed some improvement up to the time of the last fulguration, September 12. At this time it was decided to make a severe test of the fulgurating spark, as it was necessary for the child to be removed to a different locality where he would not have opportunity of treatment or observation. Following this seance there was marked laryngeal reaction and labored breathing, continuing for five days. As the reaction was so severe it was determined to do a tracheotomy, which was performed, September 17. The next attempt at fulguration was made October 24, but as the patient took the anesthetic

badly the spark was not applied. Subsequent to this, a number of fulgurations were given at varying intervals, it being easier of accomplishment after the tracheotomy-tube was in place. On the night of January 20, about 4 a. m., the child pulled out the tracheotomy-tube and died from asphyxia before the house surgeon could reach the ward. The nurse made an unsuccessful attempt to reinser the tube.

CASE 4.—E. F., a girl, aged 3 years, came to the clinic July 11, 1912, with symptoms of whispering voice and difficult breathing since birth. Her health had otherwise been always good. There was no history of either tuberculosis or syphilis. Examination of the larynx revealed multiple papillomas. Fulguration was first applied July 12, and there was immediate improvement in the voice. It was again applied July 18 and August 1 and 15, when she returned home and came to the hospital for treatment. September 1 she developed a diffuse bronchitis and was brought to the hospital; she recovered. September 28 she was fulgurated, following which there was some edema. In October she developed diphtheria in the ward and an immediate dose of 10,000 units of anti-toxin was administered. She was carried to the infectious hospital where intubation was done, but died a few days later of pneumonia.

CASE 5.—A history of this case has been mislaid, so that the report is made from memory. The patient was a little girl about 3 years old, who complained of hoarseness for two years. She was brought to the clinic where in addition to tonsils and adenoids the presence of laryngeal papilloma was discovered. Under local anesthesia fulguration was applied at varying intervals for three times, after each of which the larynx cleared up and the voice became better. There was no history of tuberculosis or syphilis. The child was well nourished and thick-necked. There was a long period following the last intubation in which there was no recurrence of the papillomatous growths. Just as hope was being raised that we had succeeded at last in overcoming the papilloma, the child developed measles and was taken to the Willard-Parker Hospital, where she recovered from her measles without any recurrence of the growths. Since the dismissal from the hospital no subsequent history has been obtainable.

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ABSTRACT OF DISCUSSION

DR. ROBERT LEVY, Denver: It is interesting to know that Dr. Smith has recommended in his paper a return to the thought expressed a great many years ago concerning the value of treatment by tracheotomy and waiting for the spontaneous disappearance of these growths. They have a certain life history and tend to disappear spontaneously, and so

when we do a tracheotomy we put the larynx at rest and wait until this occurs. In a paper read a good many years ago I related a case that, to my mind, proved this and so up to a very recent time I have held that view and treated my cases accordingly. As a matter of fact, however, I think the time is coming or has come, when we must modify our views somewhat. The reason, I believe, for the recurrence of these papilloma with such marked rapidity after they have been removed is that they were not removed thoroughly by our older methods, and this is particularly forced on one by the reading of the last article of Albrecht, in which he reports nine cases, some of which had been operated on by the ordinary way, by direct endoscopy, with constant recurrence, after which they were operated on by the suspension method. It was noticeable that the patients got well quickly and remained well. It may be that in all these cases the time had come for these growths to disappear, but the fact remains that no recurrence took place after they had been removed by the suspension method, while after their removal by the older method they did return rapidly. Of course, the time is somewhat recent to state that as a fact on which to base our future conduct in these cases. We can, however, by this means remove these growths very thoroughly. I have a case at present that proves Dr. Smith's infection theory; a child eight months old had a small papilloma in the anterior commissure; under direct suspension this was removed. I thought it a particularly easy case and one that would remain well but the growth returned with increased activity.

DR. SAMUEL IGLAUSER, Cincinnati: Dr. Smith brought out most of the methods of treatment. In the series of cases that Dr. Levy referred to, I think the electrocautery was used after the removal of the papillomas. The removal of the papilloma by the suspension method, then cauterization, and perhaps prophylactic intubation to prevent edema would be good treatment. I now have two cases under treatment in which, through the kindness of Dr. Ransohoff, I have been able to employ radium. In one case, in an infant, the radium tubes were applied on the outside of the neck for several hours. A slight burn occurred on the skin but the papilloma did not disappear. In the second case I put the radium inside the larynx three times, with better results, and I think perhaps if Dr. Smith were to apply the radium for longer periods he might get better results. In my case it was applied five or six hours with no bad effects. The first time I tried radium I had some trouble in keeping the capsule in the larynx and I hit on this method; I put the capsule in a rubber tube slit on the side, like a drainage tube, with a string tied to it. The V-shaped cuts in the rubber tube acted like flanges to retain it in position. It held so well that on one occasion I had some trouble in removing it.

END-RESULTS FOLLOWING THE YAN-KAUER OPERATION ON THE EUSTACHIAN TUBE

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In 1910, Dr. Yankauer published a report of twenty-one cases in which the bony end of the eustachian tube had been curetted for the purpose of shutting off infection from the nasopharynx and thereby curing chronic suppuration of the middle ear. According to Dr. Yankauer, middle-ear structures were removed in only two cases. Polypoid tissue was removed only when it became necessary to allow room for operation.

Most of the patients were using drops or powder at the time of operation and were allowed to continue. Syringing the middle ear was also a part of the post-operative treatment. Granulations were touched with silver nitrate.

The average time required for healing was six months. Sixty per cent. of the patients were cured. No mention, however, was made as to the condition of the tube at the final examination of the patients.

In a later paper, read before the Otological Congress in 1912, Dr. Yankauer emphasized the necessity of treating pathologic conditions of the nose and throat, before a suppurative process of the middle ear could be cured. He also advised the removal of sloughing ossicles and polypi.

The following is a report of twenty-five cases in which the Yankauer operation was performed at the Massachusetts Charitable Eye and Ear Infirmary, during 1913, by courtesy of Drs. Crockett and Mosher.

The duration of discharge has ranged from two to thirty-five years, with an average of sixteen years. The Roentgen ray has shown nearly all of the mastoids sclerosed, the sclerosis varying in degree from a slight density to complete obliteration of the cells. Transillumination, with Dr. Mosher's transilluminator, showed little light passing through the mastoid.

All the patients were given a hearing test before operation. Most of them were suffering from some pathologic condition of the nose or throat, from which the ear trouble undoubtedly had its origin.

The operation consisted of denuding the bony eustachian tube as far as the isthmus. The ossicles were not removed, granulations were not disturbed, and no medication whatever was used. Postoperative treatment consisted in wiping the ear dry several times a day. Three patients complained of dizziness following the operation, one of whom was admitted to the hospital, and remained in bed about two weeks. Dizziness gradually disappeared.

The radical mastoid operation has been performed on four of the patients since the tube was curetted. Two of these had a very foul discharge containing flakes of cholesteatoma, with no apparent improvement from operation. The other two developed symptoms of acute mastoiditis about two months after curetting the tube. The mastoid operation disclosed a large antrum containing cholesterol and pus.

In three of the cases, the tube was curetted a second time, and the remaining ossicles and outer attic wall were removed. In two cases the nasal septum was straightened and the nasopharynx curetted.

Ten months have elapsed since the first operation, and about seven since the last, with an average of about eight and one-half months.

Many of the tubes have opened and closed several times since operation. Several cases in which the ear has been perfectly dry, at least once since operation, now show a profuse discharge.

Bands of adhesions extending from the anterior portion of the tympanic ring to the promontory were noted in three patients. In most cases the granulations showed a tendency to shrink down as the ear became dry, although the tube remained open.

A second hearing test was made on eleven patients. Five showed slight improvement in air conduction. The patient showing the most marked improvement increased from 8/35 to 2/25 voice sounds, and from 128 to 64 fork. There was no improvement in the remaining patients tested.

Recent examination of the above cases discloses the following condition:

Tubes open with granulations and discharge..	11 cases
Tubes closed with ear discharging.....	1 case
Tubes open with ears dry.....	8 cases
Tubes closed with ears dry.....	1 case

Out of the twenty-five cases, in but one has the tube remained permanently closed with ear dry.

Of the tubes reported open with ears dry, three have been curetted a second time, and in two other cases the nasal septum has been straightened and adenoid tissue removed.

A certain percentage of chronic mastoids with cholesteatoma will eventually require a radical operation to bring about a cure. In this type of case curettage of the tube, may as a result of the reaction in the middle ear, cause an acute mastoiditis, as in the two cases noted above.

After eliminating cases of chronic suppuration, in which the radical operation is necessary, we have remaining a class of cases in which the former treatment has been the removal of sloughing ossicles and polypi, together with the correction of pathologic conditions of the nose and throat.

Does curettage of the eustachian tube add anything to this treatment? In my experience it is of very little value.

I do not believe that it is possible to close the eustachian tube permanently.

535 Beacon Street.

ABSTRACT OF DISCUSSION

DR. HARRIS P. MOSHER, Boston: When Dr. Yankauer brought out his work, it seemed revolutionary to me and I could hardly believe it in all respects true. Very soon he modified his procedure. Dr. Lougee has taken the trouble in twenty-five cases to follow out Yankauer's procedure as given in his successive papers, and his conclusions, as you see, are just the opposite to those of Dr. Yankauer. Out of twenty-five cases he has had only one good result. In most cases I do not know whether we should attempt to close the tube or to regard the closure as not necessary and not attempt it. I rather feel now, that the tube should be disregarded and attention paid entirely to the middle ear.

DR. G. W. MACKENZIE, Philadelphia: I favor the Yankauer operation in selected cases. I am afraid our failures are too often due to their improper selection. Dr. Yankauer's operation is particularly fitted to those cases in which we have done a radical operation for chronic middle-ear suppuration and we feel sure that the spaces in and behind the attic are clear but the discharge persists with a patent tube. My results in about two-thirds of the cases have been very satisfactory, though in some the tube remained patulous. One criticism of Dr. Lougee might be offered concerning the cases in which on operation he found cholesteatoma. They should not be accepted as fair tests. To determine the presence of cholesteatoma by examining with the microscope for cholesterol crystals is very simple. Before we criticize the operation too severely, let us not forget that we want to find out whether or not the operation is really indicated. When the attic or mastoid is involved, of course the Yankauer operation is not indicated, but, in those cases in which we can exclude these regions and limit the pathologic process to the tube, the Yankauer operation will give good results, and, furthermore, if done thoroughly and effectually, it must succeed, for the single source of infection has been eliminated.

DR. JOHN L. LOUGEY, Boston: With regard to Dr. MacKenzie's remarks concerning the selection of cases, I admit that I did not examine the secretions microscopically for cholesteatoma. It would be difficult to select the cases that would be proper for operation. The time of duration of the discharge varied from two to thirty-five years. It is very hard to tell what is going on in the mastoid, even with the aid of the Roentgen ray. I think closing the tube temporarily may be a means of setting up a mastoiditis by shutting off drainage.

OPERATIONS FOR CLEFTS OF THE HARD AND SOFT PALATE

LINN EMERSON, M.D.

ORANGE, N. J.

A large percentage of these patients are not seen in early infancy by the operator, as the parents do not appreciate the importance of early operation. The parents of a child with cleft palate should be told by the family physician that, if not operated on before the fifth year, the child will never have clear speech no matter how good the cosmetic result, as the child will not be able to enunciate clearly if the operation is performed at a later date.

The Brophy operation should be performed before the end of the third month and Brophy himself operates as early as the second or third week. The technic, as described by Carmody in a recent paper is the following:

The patient having been anesthetized, preferably on the operating table, is placed in a semi-Trendelenburg position thus avoiding aspiration of blood. The lip is raised and with the special, heavy, curved needle a heavy silk suture is carried through the lower part of the maxillary bone behind the malar process, so that the end will show above the palate process, when it appears at the inner border. Care should be exercised to avoid injury to the teeth by working the needle between them if possible. The silk is caught with the tenaculum hook and the needle withdrawn. A needle with the curve in the opposite direction is used in the same manner from the opposite side, leaving silk with closed loops facing each other. The needle is then carried through in the same manner in front of the malar process from both sides, and

on the longer side an extra loop farther forward. By looping one loop through the other, as first used by Mason, and withdrawing the surrounding loop, we have one double silk strand from one buccal surface to the other. These are replaced by drawing through, by means of this silk, a double silver wire.

On these wires are threaded lead plates, and it is important that the holes should be the right distance apart, so as not to cause buckling of the plates if at too great a distance, and so that the wires will not cut the tissue if too close together. Personally it seems that not enough care is taken in making the holes in these plates, as portions of lead if left, although soft, will irritate the tissues. For this purpose, the ordinary rubber-dam punch of the dentist is used, which leaves a clean-cut hole with smooth surface on the side placed next to the tissues.

The wires are then twisted together, one of the posterior with one of the anterior, care being taken that the same wires are twisted on each side. This will bring the parts together with comparative ease if the patient is not too old, or the cleft is not too wide. If the patient is over 3 months old, this operation should not be performed unless the cleft is very narrow. If the cleft is wide in the younger child, I have at times found it necessary to sever the malar process from the maxilla, as recommended by Brophy. This will allow easier approximation.

The palatal process of the maxilla, and horizontal portions of the palate approach each other so that they are almost in contact. The edges should be freshened, being careful to cut completely through the mucous membrane and periosteum; the wires should be tightened, thus bringing the parts in close contact, and completely stopping hemorrhage.

If the premaxilla is protruding, it is best to force it backward into normal position at the same time, not by simply drawing it back, thus causing a bending of the septum which produces obstruction of one nasal passage, or, as is the habit of some operators,

simply to make an incision in the septum, and slip one part of the cartilage past the other, which will produce a thick septum, partially or completely blocking one or both nasal passages.

My method, while not entirely original, is to remove a wedge-shaped piece, base down, subperiosteally from the septum, thus avoiding injury to the nerves and blood-vessels; the space from which this is removed is obliterated by forcing back the premaxilla, leaving a septum smooth on both sides. It is necessary to freshen the edges of the premaxilla, and also the maxilla, in the same way as in the case of a single cleft.

The mortality in the early months of life in the hands of the occasional operator, has caused me to give up the early operation altogether. If complicated by harelip, I usually repair the lip during the first few months, and close the palate some time during the second year.

Of all the literature I have consulted, the monograph of Owen is the most valuable. His ideas have been followed mainly in my work. I desire to give full credit for quotations and illustrations.

The operation considered and here described will be that for uncomplicated cleft of the hard and soft palate: the instruments recommended by Owen were used, with one or two exceptions. The Whitehead mouth gag is very satisfactory. The extension piece to the tongue depressor, should be removed for use with children, as it is too long, and crowds the base of the tongue over the laryngeal opening. The two curved steel raspatories, angular scissors, wire-twisting forceps, long mouse-toothed forceps, scalpel, artery forceps (for sponges), Sim's hollow needle, tenaculum, and Graefe cataract knife, complete the list of instruments required.

The patient should be liberally fed during the week preceding operation, and should have the rectum and lower bowel well cleared out by enemas just before operation. This permits withholding everything, even

water, by mouth, for seventy-two hours following the operation.

The chloroform can best be given with a Junker inhaler, but this is not absolutely necessary as a skillful anesthetist can keep the case well in hand with a gauze sponge on a convenient carrier.

As the operation is a tedious and back-breaking procedure, the position of the patient is of considerable importance. Owen recommends the head hanging over the end of the table, conceding, however, its interference with the respiration. The Trendelenburg position is more satisfactory, but the legs, when flexed over the end of the table, should be protected by having the table covered with several thicknesses of blanket to prevent injury from pressure during the necessarily long operation. This position will bring the head of the child of 5 at about the middle of the table, waist high, thus enabling the operator to vary his position from time to time. If he becomes wearied by standing, he can work with equal ease and comfort sitting on a moderately high stool.

The blood accumulates in the vault of the pharynx and is easily removed by stick sponges. While ordinary portable electric light affords a suitable illumination, it multiplies the number of assistants and interferes with the operator's view of the small field of operation; therefore, the electric photophore is much to be preferred.

Before the introduction of the mouth gag a heavy silk suture is passed through the tongue. This is tied tightly across the lower bar of the gag after its introduction, and serves to prevent the tongue from falling back into the throat.

The first step is the denudation of the margins of the cleft, and epinephrin is first used to reduce the hemorrhage to the minimum.

Instead of denuding deeply and cutting the periosteum from the margins of the bony cleft, thus removing a part of the tissue which should be left to form the flaps, only a thin shaving of the mucous

membrane should be removed from the edge, but great care should be observed that the margins are denuded through their entire extent. Owen recommends the use of a blunt bistoury, but in my experience there is nothing that equals a Graefe cataract knife. Its keen, narrow blade ensures rapid and perfect denudation and, under suitable illumination, there is no danger of doing damage with its sharp point.

The next step is a radical departure from Brophy's procedure. While in his skilled hands the dissection of the periosteum from the hard palate with his curved periostomes working outward beneath the denuded margins, is no doubt possible, I feel sure that in most inexperienced hands it would result, as it did in mine, in the tearing of the mucoperiosteal flaps.

Figure 1 (from Owen) shows the location of the lateral incisions and they can be made longer than is shown in the figure if necessary.

The closer these incisions are made to the teeth the less the chances of wounding the larger branches of the descending palatine arteries, the broader will be the flaps, and the less likelihood of their blood-supply becoming impaired.

The incisions pass through the mucoperiosteum down to the bone.

With a raspary of moderate curve introduced through these lateral incisions the mucoperiosteum is readily detached from the hard palate until the end of the instrument appears at the margin of the cleft. An instrument whose curve is more nearly a right angle is then introduced in an outward direction, and by their alternate use the mucoperiosteum is completely detached.

At this time considerable hemorrhage is encountered which is controlled by pressure and the use of epinephrin. The blood is removed from the pharynx by small absorbent cotton sponges carried on Halsted artery clamps or suitable sponge holders.

Figure 2, from Owen, shows the operation up to this point, and the firm connection between the pos-

terior margin of the hard palate and the velum. This is severed by the introduction of a pair of scissors curved on the flat and on the complete severance of this attachment will depend the success of the operation.

When properly severed the mucoperiosteum and the velum hang loose and are easily approximated to the corresponding flap of the opposite side.



Fig. 1.—(From Owen) showing lateral incision.

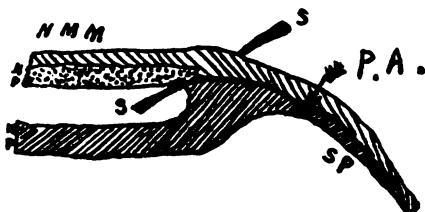


Fig. 2.—(From Owen.) *H. P.* and *S. P.*, junction. *M. P.*, mucoperiosteum detached from *H. P.*. *N. M. M.*, mucous membrane from floor of nares. *S. S.*, blades of scissors to cut through aponeurosis of membrane.

Even when this has been done the most difficult part of the operation is yet to follow, namely, the introduction of the sutures. Undue stretching and laceration of the flaps are liable to occur when the old-fashioned curved needle is used and the flaps necessarily held by a pair of forceps.

The introduction of the tubular mechanical needle by Owen was a great saving of time, but its use, even as he describes it, makes it necessary to grasp the

flaps with forceps and considerable traction ensues when the needle is withdrawn. In its use, as I shall describe it, the time required to introduce the sutures is reduced by more than one-half and the flaps do not have to be grasped by forceps. Thus bruising and laceration of them is obviated. Owen lays great stress on having an assistant to look after the needle to see that the end of the wire is just inside the tip of the needle ready for emergence when the wheel is turned after the needle has been passed.

It has not been my good fortune to secure such an assistant, and the rapidity with which the sutures can be introduced by the method I am about to describe leads me to keep the needle in my own hand and manipulate it myself. It goes without saying that a mechanical needle of this sort, to be of value, must be a perfect instrument. After having had three instruments submitted to me by various instrument makers, all of which were unsatisfactory, I induced Meyrowitz to send to Weiss, of London, for the needle here shown. I have found it almost a marvel of perfection. The mechanism is very simple and I have never known it to balk or fail. Meyrowitz has since made such a needle using mine as a model.

The advantage of putting the stitches in from before backward is that the posterior ones being put in last leaves the operator free to sponge the blood from the pharynx at frequent intervals without pulling on the stitches or palate.

If the posterior stitches are put in first they are liable to become caught and torn out by the frequent sponging.

In introducing the needle from the oral side of the flap, as is usually done; it is necessary to pull the flaps downward, and even when held by forceps considerable difficulty is encountered on account of the small space in which one must work. The procedure recommended is the following:

The needle is entered between the flaps into the nasal cavity, rotated to one side and the point pushed

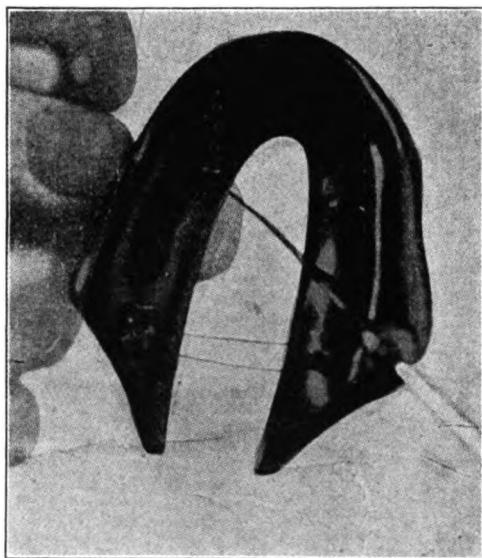


Fig. 3.—Showing manner of passing suture with hollow needle.

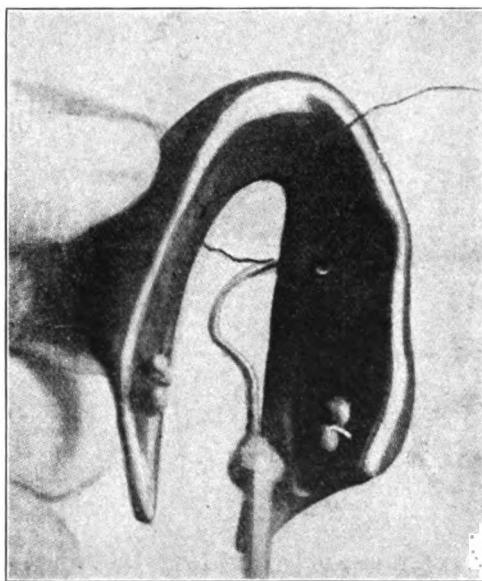


Fig. 4.—Also showing manner of passing sutures with hollow needle.

through the flap from above downward, the point entering the flap on its upper surface and emerging on the inferior or oral surface.

(Fig. 3 indicates its position.) As soon as the point emerges, the milled wheel is turned and about 12 inches of the silver wire extruded from its point. The reason for extrusion of such a long piece will be noted as the description proceeds.

If difficulty is experienced in forcing the needle through the flap a pair of forceps, or, better still, the long curved scissors can be pressed against the oral surface of the flap.

The blades of the scissors are slightly separated at their points and through the separation, the point of the needle emerges. The needle is now withdrawn and the point rotated through 150 degrees in the nasal cavity and passed through the opposite flap in exactly the same manner. (Fig. 4 indicates its position.)

It will be noticed that the wire which projects from the end of the needle is folded back on the outer side of the needle in its passage through the second flap and forms an angular loop at the tip of the needle. This loop is increased in size by the extrusion of two or three inches of wire. The wire is then cut off and the needle removed.

The reason for the long end on the opposite side now becomes manifest. Close to the under surface of the second flap is the kink in the wire made by its being folded back. If this kink is left near the flap, the wire is almost sure to break when it is twisted to tighten the suture. The short end of the wire is now seized and gently pulled out until each projecting end is about 8 inches long. This fine wire pulls through the flaps with perfect ease and no traction or cutting out ensues. The two ends of the wire are grasped by an artery clamp and passed to the anesthetist or an assistant. Thus from seven to ten sutures are inserted passing from before backward.

Before putting in the last two sutures which hold the uvula, two sutures are passed far out from the median line to prevent the tensor palati from pulling and tearing out the stitches in the soft palate and uvula.

These are shown in Figures 5 and 6. (Also in Figs. 3 and 4.) Instead of being united across the roof of

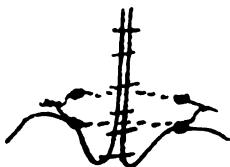
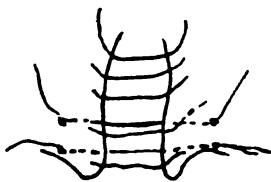


Fig. 5.—Upper, showing sutures inserted.
Fig. 6.—Lower, showing sutures tied.

the mouth, as are the other sutures, to prevent their tearing out, they are shotted and their short ends twisted together, as shown in Figure 6. Thus, even should the shot come off, there would still be a loop over the bridge of tissue and little probability of their cutting out.

The after-care of a case requires a nurse of considerable tact and skill. In children, if struggling and crying follows attempts to use the antiseptic spray, it is best to omit it. If possible, absolutely nothing should be given by mouth for seventy-two hours, conversation should be inhibited as much as possible, and children entertained in every conceivable way. Nutritive enemas alternating with large amounts of saline solution passed high into the bowel will maintain the strength and allay thirst.

ABSTRACT OF DISCUSSION

DR. G. HUDSON MAKUEN, Philadelphia: Dr. Emerson has given a good description of a well-known operation for cleft palate. It has its limitations, as all operations on the palate have. Its chief limitation is that it leaves a velum that is too small and tense to perform what has been called its valvular function in respiration, phonation and articulation. Every operation on the palate fails in this respect, because even though a full quota of tissue may be present there must always be some cicatrical contraction in the line of union between the lateral halves. The Brophy operation, however, although a more extensive and serious one, does give us a more useful soft palate. I have seen some of his cases in which the soft palate very nearly fulfilled its normal valvular function. Dr. Brophy has recently made an addition to his operation. In those cases in which tissue seems to be lacking, he enlarges the velum by means of flaps from the posterior pillars, thus making a longer soft palate. As Dr. Emerson says, the operation should be done before the habits of speech have been formed. No operation on the adult palate can change or improve the speech to any great extent; it can only make it possible for the patient to learn how to speak better. It is a difficult proposition to change the habits of one's speech. We all have our speech habits and we cannot change them offhand. The patient with a cleft palate has characteristic habits of speech, which have become, in adult life, a fixed part of his psychical as well as his physical equipment, and they cannot be changed by merely changing the physical properties of the peripheral mechanisms of speech, but only by careful speech training, in which not only new muscles are brought into action but changes are made also in the auditory and other speech centers of the brain. This is an important matter in connection with cleft-palate operations in adults and even in children of 6 or 8 years of age. As I have said elsewhere, I think I can take a patient with a cleft palate and do more for his speech by psychophysical training than can be done by an operation without training. This, however, is not an argument against the operation, but only a plea for the training which must follow it, and I may add that the necessity for the training increases with the increase in the age of the patient at the time of operation.

DR. T. E. CARMODY, Denver: In speaking of the operation for cleft palate, I will take issue with Dr. Makuen, because I have had some cases in which operation late in life has been satisfactory and the patients have obtained a very satisfactory enunciation. However, my practice is to do all the operating I possibly can, and usually it is possible before the fifteenth month—before the child begins to talk—and better habits of speech are then formed. I reported in a recent

article a patient operated on, a young woman of 19 years, who had been associated with a nurse for some time, and who left the city and on coming back four months later and calling the nurse up on the telephone asked her to guess who was talking and she could not. So her habits of speech could not have been bad. I have tried Dr. Emerson's lateral incision with good results, but generally it is not necessary, as we usually have enough tissue. I have seen something like 400 cases of my own and with Dr. Brophy and others, and have only seen one case in which there was lack of development. There is only lack of union. Very frequently a flap of nasal mucosa can be used either from the nasal side of the palatal plate or from the septum, and in one case I have used a flap from the inferior turbinate. I think the lateral incisions interfere with the action of the soft palate, because a flap is obtained that is not pliable, and the velum will not act as it should. Dr. Emerson has given some good methods for the after-care of these patients.

DR. OSCAR WILKINSON, Washington, D. C.: I have used some aluminum plates which are left in for two or three weeks.

DR. LINN EMERSON, Orange, N. J.: As to Dr. Carmody's remarks regarding the lateral incisions not being necessary, that I concede, but the operation which I have reported is done with a view of shortening the procedure. While it used to take me two hours, I can now frequently do it in forty-five minutes. With the use of the Graefe knife and the elevator one can strip it up in two or three minutes, whereas by the other procedure it takes a long time and one is much more liable to tear the flap. As to taking tissue from the turbinate, that can be done, but the disadvantage is that this tissue is so thin that the stitches pull out, and the blood-supply is so poor that necrosis or non-union ensues. As Dr. Carmody has shown, if the flap is loosened enough this tissue is not needed. Another point is to put the sutures in far back instead of too close to the edge. In my first operation I operated four times before I got closure; now it is rare that I have to operate more than once. There is no question of the merit of the Brophy operation, but most of my cases are in older patients. As to the mortality of the early operations: of course the younger the child the higher the mortality. These patients have a low index and since this paper was written I have lost two—one thirteen months old and one eighteen months old. Necropsy failed to show the cause of death. Both died the next day after operation with high fever, 105-6. It is possible that the anesthesia had something to do with it. In the next operation I do I shall use gas and oxygen. Relative to the improvement of speech, I have one patient on whom I operated at 11 years. He came daily for several months for training and Dr. Makuen well lays stress on the importance of that. He now has almost no noticeable impairment of speech.

THE ORIGIN OF LABYRINTHINE REST-TONE

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NEW YORK

I purpose to account for the origin of the tonus which I believe emanates from every functioning static labyrinth, and which in action and in rest assists to orient us in space.

It can be shown that the otolith organs contribute their share toward rest-tonus, besides assisting in determining positions and motions in space both rectilinear and curvilinear. It is known that influences from many other sources aid the labyrinth in its work, but at this time I will ignore all these, as I desire to concentrate the argument on the semicircular canals.

The semicircular canals are so placed relative to each other and to the utricle, in both temporal bones, that endolymph flow cannot normally occur in one canal without influencing the flow in the other two.

Barany¹ has shown that all three ampullae of both labyrinths are in relation with all six eye-muscles of both eyes, and that we can account for the simultaneous contraction of one set of eye-muscles, and the relaxation of another set, due to peripheral stimulations causing nystagmus, only provided there exists a resttonus in the cristae of the canals.

Nystagmus is not necessarily more truly horizontal, or truly rotatory when the external or the superior canals are respectively exactly in the plane of rotation; nor as I have observed necessarily truly in the plane of the canal enduring maximum caloric excita-

1. Barany: Ninth Internat. Otol. Cong., 1912.

tions. Moreover, the position to obtain a given nystagmus varies in different people.

It follows that the character of all nystagmus is dependent on certain combinations of ampullae stimulations (+ or —), and that normally one ampulla never alone determines orientation phenomena.

Shambaugh² has demonstrated on a fistula patient, that the: "duration of nystagmus = duration of peripheral stimulation = duration of endolymph current." He concludes that this eliminates the necessity for tonus centers to control the duration of nystagmus, and that it is a potent argument for the origin of labyrinth tonus from the hair-cells of the cristae. From Ewald's and caloric experiments, it also appears that Shambaugh's conclusions are correct. Ewald obtained a greater reaction with flows toward the horizontal ampulla, than with those away from it, and in the vertical canals, greater reactions with flows away from the ampullae.

These facts suggested to me an explanation of the origin of rest-tone, and of many phenomena intimately connected therewith.

In passing, please note that in Ewald's experiment, the opposite labyrinth was functioning, whereas in Shambaugh's the opposite labyrinth was destroyed. This circumstance may partly account for the differences in the amount of reaction obtained between to-and-fro currents in Ewald's, and the lack of marked differences in the reaction from such current in Shambaugh's experiment.

From the foregoing I deduce the following:

1. Physiologic endolymph movements excite impulses from the end-organs, which are interpreted as sensation complexes from all the ampullae. If the impulses from the two labyrinths approximately balance (or through practice are balanced by the aid of the coordinating apparatus), no sensation of movement

2. Shambaugh: Ninth Internat. Otol. Cong., 1912.

is experienced. Binaural galvanic or caloric reactions with the head anywhere in the anteroposterior vertical plane demonstrate this clearly, as does the rotation of bilaterally non-functionating labyrinths.

2. The body normally receives a sensation-complex (and a tonus) in the anteroposterior vertical plane, approximately equal from its two sides, but in all other positions, various complexes (toni) must be forthcoming, depending mainly on the position of the head. Any other assumption would not account for balance phenomena observed in the various positions of the body.

3. Labyrinth tonus originates from all the labyrinth end-organs. Postdestruction phenomena also prove this to be true.

4. Endolymph stress is amply capable of maintaining static control in rest, as it does so in action.

5. Positive endolymph stress, within the canals at rest, can occur only because of convection currents ever present therein. I have shown elsewhere³ that convection currents may be caused by disease, and I shall attempt here to explain their occurrence in health, in one or two ways:

1. By a difference in temperature between the inner and outer labyrinth walls. This may be simulated by binaural caloric irrigations. Under this influence, the moment the head is moved from the anteroposterior vertical plane, there arise marked unbalance phenomena, due to the placing of the canals in one side of the head more nearly in the optimum, and those within the other side of the head more nearly in the pessimum position for caloric reactions. This theory of thermic differences is therefore improbable, in health.

2. By a constant, but variable difference between the temperatures within the ampullae and the non-ampullated portions of the canals. Is such a difference possible?

3. Fowler, E. P.: The Effect of Local Autogenous Temperature Variations, *Laryngoscope*, March, 1914.

The temperature of the brain is normally higher than the blood supplying it,⁴ and blood-vessels coming from within the cranium contain blood of a higher temperature than do those from without. The internal auditory artery, a branch of the basilar, traverses the inside of the skull before it distributes its blood-heat to the ampullae of the semicircular canals. This heat is transmitted mainly by conduction and radiation to the ampullae, and as the tiny twigs lie along the concavity of the canals, these receive less and less heat the further the vessel courses from its source.

Because of the heat, the specific gravity of the endolymph adjacent to the ampullae is lowered, and within every canal not in the horizontal plane a current is impelled by the force of gravity which establishes, and maintains, a stress on the cupulae of all the canals, at all times.

The specific heat of the spongy labyrinth capsule is 0.71, whereas that of the compact inner labyrinth walls is 0.3, which indicates that whereas protection from the sudden external variations in temperature is provided, changed temperature gradients arising from internal heat variations are quickly established. Moreover, the temperature gradients from the ampullae are more abrupt than would otherwise obtain, because the conductivity for heat of the hard bony canal walls is better than that of the surrounding tissues, and it seems as though the temperature within the ampullae would always be higher than the temperatures elsewhere in the canals, because of these facts and because the blood-supply of the outer labyrinth capsule is derived mainly from the tympanic and other vessels, most of which have not traversed the inside of the cranium, and which must contain, in consequence, blood of a lower temperature than the ampullae vessels, and furnish the principal means of heat dissipation for the static labyrinth and its contents. It follows that the endolymph rest-currents

4. Foster, M.: *Physiology*, p. 477.

will vary directly as the velocities and amounts of the local blood-supply.

If both labyrinths be normal, and the head is inclined in various directions, why do we not, under these conditions, get an unbalance similar to that experienced during binaural caloric irrigation with the head in any but the anteroposterior vertical plane? At first sight it would appear difficult to fathom this mystery.

If normally there exists constant stress from convection currents within the membranous canals, these currents, owing to the position of the canals as regards the horizontal, in all animals, will be during the greater part of life in the following directions:

In the superior canal, toward non-ampullated end, therefore in + stimulation direction.

In the posterior canal, toward non-ampullated end, therefore in + stimulation direction, aided by superior canal flow.

In the horizontal canal, toward ampullated end, in + stimulation direction, aided by superior canal flow.

Note that the flow in all the canals is in the + stimulation direction. I designate the endolymph pressures and flows, + or —, depending on their direction, in, or not in, the direction of greater ampullae stimulation.

The difference between the direction of + stimulation flows in the horizontal and vertical canals may be explained on the theory that end-organs in the habit of furnishing a tonus derived from endolymph flows in fairly constant directions would only respond to such flows, or at least respond to such flows more readily than to absence of, or to minus flows, in either of which latter eventualities relaxation of the usual tension on the hair-cells of the cristae would occur. In many positions of the head, the endolymph convection currents will be reversed in some canals, in others augmented or retarded. Thus untold numbers of flow combinations and a like number of tonus (stimula-

tion) complexes are brought about and in any and every position of the body and head in space a definite suitable rest-tonus is provided for balance and orientation.

The fistula, galvanic, rotation and caloric experiments are all grossly abnormal, and really demonstrate but little except when positive, but a study of these tests reveals nothing incompatible with the theory of convection current control which I have advanced.

Long ago E. Cyon⁵ observed that the obstruction by division of one or more of the canals caused transient effects, provided it was not bilateral and unsymmetrical. This can be accounted for only by assuming the presence of a rest-tonus from the cristae, due to constant endolymph stress. The unsymmetrical bilateral nullification of endolymph flow would naturally be more difficult of recoordination, than symmetrical or unilateral nullifications. Caloric experiments also support this contention.

I have observed spontaneous nystagmus which with the vertigo, was distinctly influenced by changing the position of the head. Why does a patient with a recently destroyed labyrinth lie on the sound side? We are told that it is because he can thus increase the resistance to the nystagmus by being in a position better to turn his eyes toward the side of the slow component. Although this is true, it occurred to me that it is also true that in the side position assumed by these patients, all the ampullae of the functioning labyrinth lie at a higher level than their canals, and thus the higher temperature which I believe resides within the ampullae is rendered less potent as an instigator of endolymph currents (rest-tone) than in any other position of the body. The upper labyrinth being dead, but little unbalance phenomena occur.

With total absence of endolymph flow in both labyrinths, no vertigo or nystagmus, etc., can physiologically be aroused, nor can tonus exist.

5. Cyon, E.: Thèse de Paris, 1878.

I have observed many patients in whom rotation failed to elicit nystagmus or vertigo, and yet caloric excitations reacted strongly and readily. I explain this seeming anomaly as follow: these are usually nerve deafness sufferers (often specific cases). Their whole auditory apparatus is below par. Hence the usual analogous canal currents during and following rotations are insufficient to elicit reaction phenomena, whereas unilateral or unsymmetrical bilateral flows, being more irritating stimulation complexes, are wont to give exaggerated reactions. This seems the most probable explanation because normally the caloric tests are the weakest we employ to determine presence of function.

The straight line filaments of critical velocity flow (the working flow of the canals) tend to continue during and after changes in position, and unless the changes are sufficiently sudden (acceleration speed, + or —, sufficiently great) the current changes are so gradual that no motion is sensed. In Shambaugh's case, the flow could not continue on stoppage of the pressure, owing to blockage of the canal tested by inflammatory lesion. Hence nystagmus, flow and stimulation were coincident. In Ewald's experiment, flow and stimulation in the tested canal were coincident, but the opposite labyrinth was acting, and when the stimulation from the fistula pump ceased, this acting labyrinth supplied the stimulation which produced the phenomena.

The continuance of the sensation of turning after rotation, or after caloric irrigation has ceased, and the delay in sensing actual rotation, may thus be partly explained by the persistence of critical velocity flow.

There are many other facts which lend themselves to my theory of labyrinth tonus. I mention the following:

In those cases of vertigo due the so-called auto-intoxications, high blood-pressure, animal or vegetable

or mineral tissue poisons, etc., how can we account for the various forms of vertigo experienced, except by a more or less transient bilateral inequality in the impulse complexes? Surely if the poisons, blood-pressure or other factors were bilaterally equally distributed to the vestibular and other coordinating mechanisms (as they would be through equal blood-supplies to both sides of the head), vertigo could not result. The stimulation impulses from the two sides would balance each other, and simply heighten or lessen tonus. Of course lessened tonus can beget, as can weakness from any cause, lack of normal balance control, but cannot beget, during rest, rotary vertigo. Rotary vertigo, then, can come only from bilaterally unequal or unsymmetrical excitations of the coordinating nervous mechanisms. This is normally possible only through the action of the vasomotor nerves.

The vasomotor nervous system is the great body tone maintainer, and through its control, variations in blood-pressure, nutrition, temperature, etc., are kept within certain bounds. The temperature gradients within the semicircular canals and utricle depend mainly on the size of the labyrinth vessels, and therefore unstable vasomotor phenomena in these vessels will affect tonus poise. Unsymmetrical vasomotor phenomena are common in many patients vertiginously inclined. Vasomotor influences anywhere along the coordinating tracts may cause vertigo, but I maintain that unless these influences be bilaterally unequal it is inconceivable that vertigo will result.

It can be demonstrated by careful rotation and bilateral caloric tests that every subject of vertigo presents a changed and bilaterally unequal sensibility to these labyrinth stimulants. This sensibility may be more marked in one stimulation complex, than in another, and is explainable by the theory of tonus maintenance I have outlined.

Finally I desire to call attention to the fact that within the animal body there exists no canal or system of canals wherein the circulation of fluid is possible that such fluid is in a state of quiescence, and it is improbable that the static labyrinth should prove an exception to this rule. The endolymph must therefore be in constant motion, maintain a stress on the cupulae, and originate the tonus emanating from the ampullae of the semicircular canals.

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ABSTRACT OF DISCUSSION

DR. G. W. MACKENZIE, Philadelphia: I hardly consider that Dr. Fowler has proved his case and I offer some suggestions. That there is a tonus no one will doubt, for in the event of sudden destruction of the inner ear on one side we observe the effects of the tonus of the other side with nystagmus and vertigo. If galvano-electricity is applied, using the anode, it causes nystagmus in the opposite direction with vertigo. So no doubt there is a tonus that can be measured in milliamperes. Barany and others have been working for years to try to locate just where this tonus is. In the event of acute destruction of one side, even when the internal ear has been removed, we are still able to stimulate the crippled side, showing that there is some tonus beyond the labyrinth. That is one point I offer. Another is that if this constant endolymph flow existed we could not explain a case I cited several years ago before this Section, in which case the external semicircular canal had had a fistula which afterward healed or closed after a mere radical mastoid operation had been performed. According to the turning test, a typical reaction was obtained that corresponded to destruction of the inner ear. Had there been such a current as described by Dr. Fowler, the tonus ought also to have been proportionately destroyed, whereas, by reason of the normal galvanic reaction which was present, it was not. Now we do know that the tonus cannot be located in the greater brain, for in animals in which the greater brain has been extirpated the animal reacts the same to all stimuli as in the normal. I think we have just as much reason to locate it in the cerebellum, which regulates the tonus of other parts of the body.

DR. E. P. FOWLER, New York: There are, of course, many points that come to mind in the consideration of this subject. I tried to concentrate the argument on the tonus arising from the canals. There is no question, as Dr. MacKenzie has said, that all factors that have to do with

body balance may play a part in the matter of tonus, and I so stated. If one labyrinth is destroyed balance is soon regained. This can occur only if the remaining labyrinth impulses are opposed or balanced by others arising from these factors, or from a throttling of the impulses from the live labyrinth. I have asked all interested in this work to mention any combination of circumstances that this theory will not cover; of course, it is only a theory, and all theories have certain apparent difficulties. So far I haven't encountered a theoretical or actual condition which we cannot explain by this theory. It is at least founded on a solid physiologic basis, and I simply offer it as a theory until further investigations shall prove it true.

SONOROUS VIBRATIONS IN THE TREATMENT OF EAR-DISEASES

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The treatment of ear-diseases with sonorous vibrations rests on the following principles:

The application of sonorous vibrations not too long continued and not too intense has a stimulating effect on the metabolism of all living cells. This action is a pneumovibratory massage. Applied to the ear it affects the external auditory canal directly, the tympanum through the membrana tympani, and the internal ear and cochlear nerve-system through the ossicles, oval window and, to a much less degree, through the tympanum and the round window.

All the structures of the auditory apparatus degenerate when insufficiently exercised; hence the necessity of intensive exercises when any of them are crippled.

Sonorous vibrations exercise the membrana tympani, the tympanic ossicles and muscles, the hair-cells of Corti's organ and membrana tectoria, and the entire cochlear nerve-system. Such exercise not carried to the point of fatigue increases the nutrition and efficiency of these structures.

The parts of the auditory apparatus or system, like those of other systems or organs of the body, are closely connected by the sympathetic. Metabolic changes in one part produce similar changes in allied parts. Thus, acute circulatory changes in the tympanic mucosa produce similar changes in that of the eustachian tube, and vice versa. This probably explains the improvement in the eustachian tube after treatment directed at the tympanum.

The Zünd-Burguet electrophone, which has been described in a previous paper,¹ was used in all the treatments and experiments enumerated herein. With this instrument siren-like scales may be produced in three timbers, corresponding to three registers of the human voice, low, medium and high. These registers may be lowered or raised, but they should be adjusted so that the scale of each overlaps that of the adjacent register. Each register has a scale of over an octave, and the sum of all the registers is a little less than five octaves, which is about the conversational range. If the harmonics and overtones produced are also considered, possibly the eleven octaves of human auditory perception are reached in the exercises. The latter consist in the production of scales in each of the registers, either applied to one ear at a time, or first to one ear and then to the other in each register, or as is usually done, alternately, first to one and then to the other ear while playing each scale in each register. Zünd-Burguet produces two scales, once in the low and once in the high register, and three times in the middle register at each treatment. Thus he starts in the middle register, proceeds to the low, then back to the middle, then up to the high and finally back to the middle register.

I complete the treatment by a short mechanical massage near and over the ear to overcome any slight numbness induced by the sonorous vibrations.

The intensity of the vibrations to each ear can be regulated, and also changed gradually or suddenly during the scales on each ear seriatim.

By this method, each note is produced for only a small fraction of a second (less than one-eighth of a second in the usual three-minute treatment), and each note is sounded at least twice for each ear.

The regulation of the intensities of the sounds used is exceedingly important. Zünd-Burguet as a general

1. Hubby, L. M.: Treatment of Deafness with Sonorous Vibrations by the Zünd-Burguet Method, New York Med. Rec., Jan. 31, 1914.

rule uses waves of not quite sufficient amplitude to cause a prickling sensation in the ear. There are many cases, however, in which no prickling sensation can be produced by the instrument used and yet the intensities of the sounds are sufficient to cause tinnitus and decreased audition. Therefore each case must be carefully studied and the intensities of the sounds graded to bring about the maximum improvement. To accomplish this in these cases, it is necessary to make tests before and after treatment for several days until the correct dosage is determined.

This brings up the subject of examinations.

The method pursued in chronic cases is to examine the ears at the start, and after fifteen, thirty, and fifty treatments.

In acute and subacute conditions, single tests may be necessary before and after treatment each time.

Thus the course and the frequency of treatments must be determined for each case, not always in advance.

Acute and subacute conditions require treatments once a day, while the chronic usually need two a day.

Good physical condition seems necessary for the most rapid improvement, especially when two treatments a day are given.

Negative results are liable to follow when the patient is in a continual state of exhaustion. This is one of the difficulties of the two treatments a day course. The pursuit of a vocation and the expenditure of the necessary energy for visits to the office twice a day sometimes prevent a successful outcome.

The usual course of treatment comprises fifty seances, two treatments a day. A second course of from twenty to thirty treatments is necessary in from six months to a year in the majority of cases of chronic deafness.

Some experiments were tried on the fairly normal ear to show the immediate effects of the treatment on audition.

A single distance test with a watch, an acoumeter, or similar instrument was made just before and immediately after a treatment on six individuals with the following results:

CASE 12.—Three cork acoumeter tests for each ear. The percentage of increase of audition distance varied from 1 to 45 per cent. The average was $21\frac{1}{3}$ per cent.

CASE 43.—Three cork acoumeter tests for each ear. Increase of audition distance 3 to 49 per cent. Average increase 20.5 per cent.

CASE 28.—One watch experiment with one ear. Increase of audition distance 18 per cent.

CASE 39.—Six cord acoumeter experiments with one ear. Increase of audition distance from 3 to 43 per cent. Average increase $13\frac{1}{3}$ per cent.

CASE 11.—Two acoumeter experiments for each ear. Increase of audition distance from 9 to 17 per cent. Average increase 14 per cent.

CASE 13.—One cork acoumeter experiment with each ear. Increase of audition distance 13 and 9 per cent. Average increase 11 per cent.

The average increase for the twenty-six experiments was 16.33 per cent.

A few observations were made to determine the length of time that a normal ear retained its improved audition after one treatment and it was found to be a little over a day.

Some tests were made on abnormal ears to find the immediate effects on hearing distance.

CASE 25.—A patient aged 60, suffering from otosclerosis with nerve atrophy. Right ear was tested three days with acoumeter, the left with cricket. Increase of audition distance from 4 to 47 per cent. Average increase $18\frac{1}{3}$ per cent.

CASE 4.—Patient aged 33, with otosclerosis, OMCC residual, nerve atrophy. One experiment with cricket with each ear. Increase of audition distance, right ear 61 per cent., left ear 46 per cent. Average 53.5 per cent.

CASE 7.—Patient, aged 47, with otosclerosis and nerve atrophy. Cricket experiments on two days with both ears. Increase of audition distance from 3 to 22 per cent. Average 14.75 per cent.

The average increase for these three chronic cases was 28.9 per cent.

CASE 39.—OMCA in boy aged 16. Tests made on seven days. On the first day a watch was used, on the other days a cork acoumeter. Increase of audition distance from — 3 to 59 per cent. Average 14 per cent.

CASE 28.—A man, aged 35, OMCA. Tests made on three days with watch showed increase of audition distance of 62, 60 and 13 per cent., or an average of 45 per cent.

SOME RESULTS IN CHRONIC PURULENT OTITIS

CASE 17.—Man, aged 27, OMPC left ear with small perforation in Shrapnell's membrane. Usual antiseptic cleansing methods of no avail after several months' trial. Perforation healed in two days after four treatments.

CASE 6.—Woman, aged 25, OMPC of both ears failed to dry after long course of treatment. Both ears dry after four days, eight treatments. She also had severe eczema of both canals which practically cleared up in two days.

CASE 24.—Man, aged 22, OMPC (R). Ear dry after three days.

CASE 8.—Boy, aged 5, OMPC (B), treated for over a year without success; both ears dry in five days' treatment, but the discharge returned with the next cold.

CASE 15.—Woman, aged 30, OMPC (L), dry after three treatments.

CASE 18.—Man, aged 22, OMPC and localized perilabyrinthitis in right ear. Dry after fifteen treatments.

CASE 21.—Man, aged 54, OMPC (B) with almost entire destruction of the drum and ossicles, and exposure of the internal carotid on the left side. Discharge reduced to a few drops in a few treatments, but the ears did not become dry after forty-nine treatments.

CASE 16.—Girl, aged 11, with radical mastoid wound following cholesteatoma, not healing in one spot after two months' treatment, became dry after fifty treatments.

Scanty dry ceruminous secretion causing itching of the external auditory canal was alleviated in at least one case of my series.

One bad case of eczema, associated with a moderate purulent discharge, was quickly relieved by the treatment.

Congestive, stenotic conditions of the eustachian tube were relieved in every instance in which the treatment was tried.

CASE 1.—Woman, aged 66. Four pounds' pressure required to open right tube, and 14 pounds for left tube, before treat-

ment. After fifteen treatments, less than 3 pounds' pressure required. (Three pounds pressure is the lowest pressure registered with my apparatus.)

CASE 9.—Girl, aged 18. Left tube required 14 pounds' pressure to become patent, before treatment. After eighteen treatments the patency pressure needed was less than 3 pounds.

CASE 19.—Man, aged 23. Left tube required 10 pounds' pressure to become patent, before treatment. After fourteen treatments the patency pressure needed was less than 3 pounds.

CASE 33.—Woman, aged 25. Right tube required 15 pounds', left tube, 10 pounds' pressure to become patent, before treatment. After thirty treatments (no second test was made prior to this) the patency pressure needed was less than 3 pounds.

CASE 37.—Girl, aged 19. Both tubes required more than 15 pounds' pressure to make them open, before treatment. After fifteen treatments the patency pressure required was less than 3 pounds.

CASE 3.—Woman, aged 32. Right tube required 10 pounds' pressure to become patent before treatment. After fifteen treatments, less than 3 pounds was required.

CASE 18.—Man, aged 22. Left tube required more than 15 pounds' pressure to make it patent before treatment. After thirty treatments 9 pounds' pressure required, and after fifty treatments less than 3 pounds' pressure was required.

CASE 17.—Man, aged 27. Left tube required more than 15 pounds to make it open before treatment; after fifteen treatments still not less than 15 pounds, but after thirty treatments less than 3 pounds were required.

Thus in the eight cases, four were relieved within fifteen treatments, one in eighteen, two in thirty, and one in fifty treatments.

TWO CASES OF ACUTE CATARRHAL OTITIS

CASE 39.—Boy, aged 16. Severe OMCA (B). The first few days inflations were beneficial for the right ear, but there was decreased audition in the left. Sonorous vibrations improved the hearing rapidly. Hearing was normal in one week on both sides.

CASE 28.—Man, aged 35. Severe OMCA (R). Audition was decreased by the mildest inflation, but attack was overcome by daily treatment with the sonorous vibrations for four days.

In the table are shown the audition tests at the first examination and the morning following the last treat-

ment with sonorous vibrations in thirty-two consecutive cases of chronic deafness.

SUMMARY OF RESULTS

The results are thus roughly summarized:

Two cases of OMPC, audition distance tripled.

Two cases of OMPC with otosclerosis: Audition distance in one increased ten times; audition distance in the other increased 50 per cent.

One case of OMPC with nerve atrophy. Audition distance on one side increased over seven times and on the other side, four times.

One case of OMPC with localized perilabyrinthitis: Audition distance more than doubled.

Three cases of otosclerosis: Very slight improvement, less than 50 per cent.

Fifteen cases of otosclerosis with nerve atrophy: Five cases had audition distance more than doubled. Five had audition distance doubled or increased more than 50 per cent. Five cases had audition distance increased only slightly.

Eight cases of nerve atrophy: One had audition distance increased about ten times. Five had audition distance doubled. One had audition distance increased 50 per cent. One had audition distance increased only slightly.

High tone limit by air conduction was raised in twenty-five ears, remained stationary in five, and was lowered in four ears.

High tone limit by bone conduction was raised in eight ears, remained stationary in three and was lowered in three ears.

Lower tone limit by air conduction was lowered in twenty-seven ears and remained stationary in seven ears. Some of the latter might have been found lowered if they had been tested with a longer series of forks.

In only two cases of the series was any improvement indicated in ossicular rigidity by Gelle's test.

One, Case 15, was an OMCC on one side and an OMPC on the other.

The other, Case 42, was a case of nerve atrophy.

These tests were made with a manometer, the amount of pressure necessary to affect the hearing for the C fork being noted.

Tinnitus was removed in nine cases, improved in twelve and in six there was no change.

Paresthesia, neuralgic otalgia, otitic cephalgia and sense of fulness in ears were removed in sixteen cases, improved in four and no change in one case.

The principal contra-indications for the treatment are acute purulent conditions of the tympanum, all acute conditions of the internal ear, great fatigue of the nervous system, and absolute nerve deafness.

The number of observations and tests enumerated in this paper are too small to permit the making of any sweeping generalizations, but are sufficient to show the usefulness of the treatment in many cases of acute and chronic conditions of the ears.

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ABSTRACT OF DISCUSSION

DR. WALTER A. WELLS, Washington, D. C.: In considering the effect of sonorous vibrations on the ear, some peculiarities of the ear as a sense-organ must be borne in mind. The auditory apparatus, which originated probably as a protective apparatus, is constantly on guard. The last of the sense-organs to go to sleep, it is the first to awake, and during waking hours, it has, apparently, no repose. Every one lives in a sonorous environment and must therefore have his auditory nerves constantly bombarded by vibrations of sound of every conceivable variety of pitch, quality and intensity. One may rest his eyes now and then by the simple, voluntary process of closing the lids. Hearing, however, is an involuntary function except so far as we may, by different degrees of attention, inhibit cortical perception. One inference from this is that an organ destined by nature to such increasing activities must suffer when it is deprived, as it is in deafness, of its accustomed stimuli of sonorous vibrations. It might also be inferred that an organ so constituted must be quite proof against fatigue and strain. The first inference I believe is a correct one, that a deaf ear suffers from a want of proper sound-stimuli, but,

unfortunately, the second is not quite true, and therein comes the limitation of the therapeutic use of sound. I have not made use of acoustic exercises for the betterment of hearing, but I have endeavored to ascertain, in some measure, the behavior of the normal ear when exposed to sounds of different pitch, duration and intensity, hoping thereby to establish some of the laws of auditory fatigue, and I believe that a knowledge of the laws of auditory fatigue, as produced by sound, is an absolute preliminary requisite to the use of sound for therapeutic purposes. I first ascertained the exact electrical energy necessary to awaken a sensation of sound of a given pitch. This, which we call the threshold of excitation, is equivalent to the individual measurement of hearing for that sound. I then exposed this ear to electrically produced sounds of a selected pitch and a certain duration, and then, without loss of time, again tested the electrical energy necessary to awaken perception for the original note. Fatigue of hearing was clearly proved, though it was surprising how quickly it was recovered from. It was particularly marked for the higher notes of the scale. I employed only musical notes and continued them for comparatively short periods. Some who have experimented on animals, however, have proved that if we use very shrill disagreeable notes, for many hours continuously, we can actually produce degeneration in the nerve-cell, localized in the cochlea. In using acoustic exercises the greatest caution is necessary in order not to exceed the limit of auditory endurance as shown by the subjective sensation of the patient, and the evidences of fatigue as manifest by loss of function. The subjective sensation may be manifested by a generally disagreeable sense of irritability, a feeling of numbness and some form of tinnitus. The loss of function is ascertained by frequent, accurate functional tests.

The results reported by Dr. Hubby show that effects can be obtained, but I believe that he will agree that extreme caution must be observed in using sounds of the right quality, intensity and duration, and also discrimination in the choice of cases for this method of treatment.

DR. L. M. HUBBY, New York: It is, of course, very important to study each individual to see how he responds to the sonorous vibrations and then to give the proper length and strength of treatment. If Schambaugh's theory of auditory perception is correct, it would explain the good results obtained with this instrument rather than with those that have very few notes. The shortness of exposure to each note at a time and the covering of the entire scale within the limits of the instrument stimulate each corresponding part of the tectorial membrane with its adjacent hair cells without the production of fatigue.

THE RELATION OF THE RHINOPHARYNX TO THE MIDDLE EAR AND MASTOID

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Several years ago, in conversation with a member of this Section who is noted for the number and success of his operations in mastoid and major cranial surgery, I remarked that if all patients with acute inflammatory ear troubles were given a certain treatment to the rhinopharynx, it was my belief that there would be few occasions for operations on the mastoid or for other grave conditions which take origin from aural suppuration, but said that I was not fool enough yet to advocate this doctrine before a body of distinguished aurists, as I did not believe it would be given a respectful consideration. His reply was that it would take a brave man to do it.

For about one-sixth of a century it has been my custom to treat the rhinopharynx as the main point in most diseases of the tympanic contents, and supplementary measures have varied only with the introduction of new agents, such as epinephrin, argyrol and hexamethylenamin.

Volumes have been written on the relation of diseases of the nose and nasopharynx to middle-ear disease, but my contention is that every case of acute middle-ear inflammation must spring from a pathologic rhinopharynx, however normal or symptomless it may seem, or may have been previously; and our most effective measures must be directed toward treating the nose and removing the cause of the ear trouble.

The cavities of the temporal bone may be looked on as accessory cavities of the rhinopharynx, which by chance happened to contain the organ of hearing, with its complex and vital surroundings. Thus sheltered, the only gateway for bacterial invasion is the eustachian tube, and if this be guarded, few germs are apt to find entrance by the blood-channels. From time immemorial, the dependence of otitis on acute coryza, and pharyngeal infections—whether tonsillitis, diphtheria or the exanthems—has been recognized, and for a generation or more its association with adenoids and grip has been known; but the latent infections from the rhinopharynx, where none of the preceding conditions have been manifest, are only now being recognized. In his recent text-book, Kerrison says he believes that "more cases of acute otitis media result from a simple nasopharyngitis, acting on an individual in whom strongly predisposing conditions exist, than can be traced to all other exciting causes combined." Likewise, in his presidential address before the American Laryngological Society last year, Dr. Leland says: "And since the ear is also an accessory cavity, nine-tenths of whose diseases originate in the mucous membrane of the nose and nasopharynx, etc."

Admitting, as all must, this etiologic relation, what advantage has been taken of it in treatment by the universally taught and practiced methods? If some operation is needed in the throat or nose, we are advised to do it; but opinion is divided as to the advisability of doing operations in acute otitis. Quoting further from Dr. Leland, he "removes adenoids, including Rosenmüller's fossae, during acute stage, to deplete the tissues, thus often obviating the necessity of lancing the drum." Personally, I prefer doing any operation of this character during a quiescent stage, for the purpose of preventing recurrences.

But how about the much more numerous cases in which no operation is indicated? We are told to keep the nares and rhinopharynx washed out or sprayed

with mild, unirritating alkaline fluids, to which may be is added sufficient phenol (carbolic acid), menthol or essential oil to give a smell suggesting "medicated." In my belief these sprays wash out only a small percentage of germs, and do not make it sufficiently disagreeable to others to cause them to move out. In the plan to be advocated, there is no call for Dobell's solution with its varied formulas, or liquor antisepticus alkalinus, or any of the sweet-scented or pink-tinted proprietaries. As will be set forth further on, this relation of the rhinopharynx to the middle ear applies equally to subacute and chronic cases, and in a measure to chronic suppurative cases also. The number of cases on which conclusions are based could probably be designated with three figures, but I believe these conclusions will be sustained by trial in other hands.

In all cases, whether acute, subacute or chronic, and regardless of the specific cause, the rhinopharynx is mopped, or rather forcibly scrubbed out, with a mixture of phenol, tincture of iodin and glycerin, to which camphor and menthol have been added, of sufficient strength to set up a violent reaction, with painful sore throat, lasting from part of a day to several days. Patients rapidly become accustomed to the effect, so that after half a dozen applications this treatment causes only a passing discomfort. Adults and children are given the same treatment, though in infants under three years old the mixture is weakened. When compressed air is available, self-restraining patients have the nostrils sprayed with a camphor-menthol-iodinized oil; otherwise it is swabbed through the lower meatus on each side, and back to the upper throat on cotton carriers, and the strength is decidedly more.

My two formulas are, first: Fifteen grains each of camphor and menthol are rubbed to a liquid; then 1 dram of compound tincture of iodin, 2 drams of alcohol, and glycerin to make 1 ounce are added. This I call camphor-menthol compound. For spraying it is

diluted with nine volumes of hydrocarbon refined oil. Practically this same formula, flavored with cinnamon oil, has been on the market for several years ready mixed under a copyrighted name.

The second formula is 1 part phenol, 1 part tincture of iodin saturated with potassium iodid, and 2 parts glycerin. This is the iodin and acid carbolic compound which I designate I. & A. C. Co.

For swabbing, a fair sized cotton mop is fixed in a strong curved Sims carrier, which is made of nickeled spring brass, or the Ayres modification, made of steel, dipped first in the I. & A. C. Co., squeezed against the bottle neck to remove excess; then dipped in the C. M. Co. and rubbed against bottle neck only sufficiently to prevent dripping. It is quickly thrust behind the palate until it strikes the vault of the pharynx, and then forcibly rubbed from side to side, unless the palate muscles prevent moving it, in which case it is forcibly pressed where it rests. I consider it important to use force in this procedure, as though it were intended to lift the patient bodily on the instrument; hence the need of a heavy stout instrument, and not a bent wire, or other device not permitting great force.

In the painful stage of acute inflammation, or in the acute catarrhal stage without pain, the nostrils are sprayed or swabbed with a few drops of a 2 to 4 per cent. solution of some local anesthetic, and from $\frac{1}{2}$ to 1 drop of 1:1,000 epinephrin. This not only contracts the vessels, but it is believed that the sedative effect of the anesthetic on the sensory nasal nerves exerts a beneficial influence on the vasomotor nerves supplying the inflamed areas; this is then followed by the C. M. Co. to the nose, and the I. & A. C. Co. to the rhinopharynx. This treatment is made only once in twenty-four hours, and the patient is not given any nasal spray or throat wash whatever. The only local measure for home use is the hot-water bottle. If the tongue is coated, a good dose of calomel, followed by

salts is ordered; if not coated, the salts only. Since the announcement that the formaldehyd-liberating drugs are eliminated by all the mucous and serous secretions as well as by the urine has been accepted as fact, patients in the acute stages have been put on regular doses of hexamethylenamin. Physiologic chemists assert that formaldehyd is liberated only in acid mediums, but there may be other explanations than the liberation of formaldehyd, of good resulting from this medication.

Several years ago, a formula appeared in some British publication, of a local anesthetic for the inflamed drum membrane, claiming to make lancing the drum painless. I tried it for that purpose, but it was a disappointment. However, I found it to be a most excellent local application, and gradually I have done away with lancing the membrane, so that I no longer make a free incision in the drum first thing, a thing very hard to do properly except under general anesthesia. This preparation is made by dissolving epinephrin (adrenalin chloride, P., D. & Co.) in anilin, 1:1,000, and then making a 10 per cent. solution of cocaine in this. Anilin, so-called anilin oil, is a poison, but just how toxic I have never been able to learn; but I have used it in very small quantities, and have not as yet observed signs of anilin poisoning, designated as coal-tar poisoning, as exemplified in over-doses of acetanilid by depression of circulation, blueness of lips, extremities, etc. These symptoms have occurred from absorption when acetanilid was used even as a dusting powder on raw surfaces. Anilin is used in large quantities in shoe-blacking and printers' inks, but only meager reports of harmful effects from handling them have been accessible to me. The reason for the anilin is that it will penetrate dermal membrane, of which the outer surface of the drum consists, softening it to permit the penetration of the epinephrin and cocaine, which localize the inflammation to the

tympanum. In the course of a few hours, rarely exceeding twelve, there is an abatement of severe pain, and usually inside of twenty-four hours, its entire annulment. In a fair proportion of cases suppuration is entirely aborted; in others, even while fever continues, the pain will disappear, the redness and bulging of the drum diminish, and the impression is created that the suppuration has aborted. Then the drum develops a small perforation and discharges a secretion, mucoid rather than purulent, which ceases in a few days.

The mode of application is to have a loosely twisted swab longer than the auditory meatus, moisten the tip with not more than 1 drop for a child, or 2 drops for an adult, carry it down to the drum, withdraw the wire carrier by a rotary motion, reverse to its winding, and crowd the excess of length into the meatus to bring a slight pressure against the drum, and retain in place; then fill the concha with extra cotton. This is done only once in twenty-four hours, during the painful stage, and one or two days longer. It requires about three days for these plugs to have all the medicament absorbed from them, when left indefinitely in a dry ear.

The result of these combined measures is to localize the inflammation in the tympanic cavity. If there be fluids or secretions which do not drain out through the eustachian tube, which in my opinion they usually do, the anilin will have softened the drum by maceration, and a nice round little perforation, usually the size of a big pin-head, will open in the lower segment of the tympanum, and stay open as long as it is needed, and then promptly close, thus behaving better than incisions which sometimes heal before their work is done. As soon as the painful stage has been passed, one or two days, swabs after the manner described are wet at their ends only with a 25 per cent. solution of argyrol, and left in the ears against the perforation, filling the

canal's full length, to act both as a medicament and a drain, and are changed daily for a few times, then at increasing intervals as recovery progresses. Cases which at the beginning present no mastoid tenderness rarely develop any, and the period of discharge does not exceed one week. When there is already mastoid tenderness of only a day or two's duration, it abates usually in two or three days, and the suppuration within two weeks. When the ear has abscessed more than a week or two previously, and the patient has the accepted symptoms of mastoid abscess, it may require nearly a month to heal in patients who finally recover. After the acute stage has passed by a week or more, inflation by the Politzer method is usually added, but I do not believe this to be necessary, as good results are obtained without it. There is steady improvement in hearing, but not so obvious to the patient as a sudden improvement by inflation, which, however, only shows that the integrity of the ventilating system is being restored, and the improvement comes from this restoration, whether inflation be used or not. During the painful stage, patients are instructed to clear their heads and throats by hawking and suction, and not by blowing the nose, which blowing sometimes inflates the tympanum, causing great pain, and also probably driving secretions back into the mastoid. Not a drop of water is ever used in the meatus, and the perfect recovery of these individuals with healed drum, full hearing and no tinnitus is anticipated with just as much confidence as we expect an eye to recover from a properly treated iritis.

For some time it was with feelings of apprehension, and almost of guilt, that medical treatment was persisted with in cases presenting clearly the indications for surgical measures as all authorities give them.

One of the things of first importance in treating almost all acute febrile diseases is putting the patients to bed, or at least keeping them in a warm room; and

yet owing to environment it was necessary for me to treat a large proportion of acute ear cases as office patients, some coming considerable distances from surrounding communities, and mostly during the cold months of the year. This necessity is regrettable, but the fact that patients recovered in spite of it adds confidence to the merits of the treatment.

The more recent the mastoiditis, the quicker it yields to treatment, but in quite a number of instances where discharge and constant boring pain have been present for days or weeks, with fever, septic look, sagging posterior wall, tender mastoid, sometimes swollen or with cervical cellulitis, discharge profusely purulent, at times blood-stained, or in chronic quiescent suppurative cases which have flared up with the foregoing picture, the cases have been brought to a favorable issue. Some of the old chronic suppurations have not only quieted down, but had regeneration of drum membrane to the point of closure, and sometimes restoration of hearing previously impaired.

A measure which may have an attractive future has occasionally been resorted to in the most urgent cases for seven or eight years past, the principle of which was based on subconjunctival injections in the eye, with which my experience has been most happy. One-half dram or more of mercuric cyanid, sometimes with a little morphin, was injected, in strengths varying from 1:500 to 1:1,500, under the periosteum over the tender mastoid; quinin and urea hydrochlorid has been used instead of the morphin, and a weak solution of ichthyol instead of mercuric cyanid. So far, the relief of pain and inflammation has been most gratifying and speedy, although the same type of swelling results as follows the injections in the eye. This produces an enormous outflow of protective lymph or serum into the tissues, which in the battle against disease, Sir Almroth Wright compares to a nation's marshaling all its forces at once, and not

sending them against an enemy in small detachments. The infiltration subsides in a few days, feeling after it begins to soften as though under the skin was a bag full of pus. So far, no patient has been given over a single injection, and the usual routine of swabbing the rhinopharynx, and draining the ears has been pursued. The two following cases are illustrations of the injection:

CASE 1.—Eliza J., aged 35, reported on Nov. 30, 1913, with severe pain in the right ear which had been operated on in Washington several years before by a prominent aurist. There was a deep fissure along the line of the mastoid wound, and the ear-drum was hard to see by reason of swelling and crookedness of the canal. There were fever, rapid pulse, loss of appetite and sleep, and tenderness of tip of mastoid and antrum. These symptoms did not yield to treatment, but increased. The covering of the mastoid became red, swollen and brawny, obliterating the sulcus of old operation, the neck was stiff, pains incessant day and night, fever continuous. The patient was fast losing strength, looked profoundly septic. December 3, an injection of mercuric cyanid with morphin and quinin and urea hydrochlorid was made about noon, and before evening the pain was entirely gone. The patient began to sleep sound, appetite returned, and pulse, temperature and complexion soon became normal. The ear had a slight discharge, which ceased by December 17. A small opening occurred at needle puncture, from which serum discharged for several days. Hearing is restored to normal.

CASE 2.—Floyd B., aged 15, reported March 4, 1914. One month previously he had severe earache for two days and nights, followed by subsidence of pain, and discharge lasting several days. After about two weeks the ear began to pain, destroying appetite and sleep, and after three or four days a swelling appeared over the mastoid causing some cellulitis, and pushing auricle forward, in which condition he was when first seen. There were fever, dizziness, rapid pulse and pale, septic appearance. There had been no discharge with the last attack, and the swelling in the meatus prevented sight of the drum. There was marked nystagmus when looking toward opposite ear. It was thought this might be a case of suppurative periostitis. A fine aspirating needle was introduced to the mastoid cortex, and several drops of thick pus were withdrawn. Injection was then made of a dilute solution of ichthyoil, which required much force to insert at first, but suddenly the last portion of about 5 c.c. went in without resistance, and it was noticed running out at the nose, thus

proving the connection with mastoid cells, either from carious perforation or natural fissure, as in some cases recently reported by Luc. Between early afternoon and evening all pain disappeared, the boy slept soundly for the first time in a week, appetite and color returned, and he came daily as an office patient for treatment of rhinopharynx, etc. To the usual treatment, vacuum suction through the nose was added. For several days he hawked profusely a discharge from the throat, dark-tinged by the ichthiol, and tasting of that drug showing that the mastoid was draining through the eustachian tube. The boggy swelling over mastoid and tallowy infiltration in neck gradually declined, during a week, and he did not have another twinge of pain. The drum when seen was intact, and no discharge appeared from it at any time. The spontaneous nystagmus soon left, but was marked from turning. Hearing is perfectly normal; no tinnitus.

In acute and subacute catarrhal deafness, the same treatment of nose and rhinopharynx is applied, plus inflations by the Politzer method. The restoration of hearing follows in direct proportion to the duration of the trouble previous to beginning treatments, which should be continued at increasing intervals until the maximum of hearing is reached and maintained. It is my belief that the maximum should equal in adults the best it has been within six months previous, and in children in twelve months previous.

In long-established chronic catarrhal otitis media, the limit of prognosis is to prevent further deafness, not claiming to restore lost hearing, or to relieve tinnitus. As a matter of fact, a fair proportion of patients do eventually improve in hearing, and have diminution of tinnitus, or its entire abatement, except when the patient has colds. The longer the disease has existed, the longer this improvement is delayed in showing. Sometimes, after a long course of treatment it will jump up as suddenly as a "jack-in-a-box," but oftener it is six months or a year or more after the treatment has been finished that improvement is first demonstrated, and it may continue to do so for several years following. Believing that artificial ventilation of the ear is a matter of minor importance,

the eustachian catheter is seldom employed, dependence being on the Politzer method. All patients are warned against taking any quinin, salicylates, or salicylate substitutes, such as aspirin, all of which I believe to be detrimental to hearing which has been severely impaired. Several relapses, some irreparable, have been observed from the knowing or ignorant use of these drugs. One patient with acute otitis with mastoid suppuration had a concurrent attack of acute rheumatism in the foot, for which his family physician gave the usual salicylate treatment. The man recovered perfectly from the suppuration, but the ear was hopelessly deafened, and has so remained for several years.

The course of treatment for the chronic cases should represent the equivalent of twice a week for three or four months. Whether this chronic middle-ear disease is due to a low-grade bacterial infection, or toxemia, or something else undefined, surpasses my ken; but if due to low-grade infection ascending through the tube, we are hitting at its source in treating the rhinopharynx.

Cases of almost life-long tympanic suppuration have sometimes stopped from a few throat-swabbings, when aural treatment alone had not been able to bring this about; so that in addition to the routine treatment of chronic suppuration through the canal, the treatment of the rhinopharynx and nares is regularly carried out. This in all probability prevents reinfections through the tubes and brings the same results as are claimed by Yankauer's method of closing them.

First National Bank Building.

ABSTRACT OF DISCUSSION

DR. OSCAR WILKINSON, Washington, D. C.: I would protest against intranasal or postnasal operative procedures during acute otitis. On two occasions I had bad results from operating on patients who were brought in from the country and insisted on operation. In the first, a double otitis media followed removal of the tonsils and adenoids in a child that

had a cold of one day's duration. In another case, I operated on the tonsils in a patient who had a cold and a peritonsillar abscess developed on the third day. I attributed both of these infections to operating during an acute inflammation.

DR. JOHN J. SULLIVAN, Scranton, Pa.: I disapprove of the methods advocated by Dr. Jones and would mention the case of a man in Scranton who, following this course, has recently had a case in which a double mastoiditis requiring operation resulted.

CLINICAL CLASSIFICATION OF ETH- MOIDITIS

E. M. HOLMES, M.D.

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As a result of the efforts of many observers during the past quarter of a century, we have acquired considerable knowledge concerning the inherent and associated pathology of the ethmoid cells. The clinical study of these cells is still of great importance, for by the knowledge thus obtained we are better able to judge of the macroscopic pathologic changes observed by direct inspection and by the aid of endoscopic instruments. Endoscopic examination of the nose enables us to inspect recesses which are otherwise hidden or at best only poorly observed. There is great need of study in this direction, for many of the findings are more positive than can be obtained in any other method. The roentgenograph is an aid which is of much service in some cases of ethmoid disease. It may give a working knowledge of the arrangement and size of the individual cells and it may be of considerable help in demonstrating the coexistence or the absence of associate sinus disease. We have also made considerable progress in our ability through surgical and medical means to relieve local pathologic conditions—those due to extension into adjacent structures, and also those due to reflex nervous impulses. From a clinical point of view there is still need of much research into the pathology and treatment of this region. We are in need of more uniform nomenclature and there must be a better understanding in regard to the best procedures, medical and surgical, for the relief of the various conditions with which we have to deal.

It is important that we do not forget that the ethmoid with the middle turbinate performs two very important functions. The air-spaces within the ethmoid act as non-conductors of heat and cold as well as other irritations, and through this structure the orbit and its contents are protected from the frigid currents of air which are inhaled during cold weather and which without this non-conductive barrier would come into close contact with these delicate structures. The restriction of the superior and middle fossae of the nose by the ethmoid with its middle turbinate and covering of erectile mucous membrane provide for the warming and moistening of the inspired air before it enters the throat and passes into the lower respiratory organs. When for any reason the middle turbinate and lower wall of the ethmoid have to be sacrificed there results a deformity which practically produces all of the ill effects of mouth-breathing. The inspired air is not sufficiently warmed or moistened and there almost always follows a chronic dry pharyngitis and a chronic laryngitis. Frequently the trachea and bronchi suffer in like manner as the upper respiratory organs. These patients almost always suffer from orbital as well as nasal disturbances whenever they are subjected to the influence of cold or dry air or to air contaminated with irritating dust or gases.

I am devoting considerable space to these preliminary remarks concerning the physiologic functions of the ethmoid and to the resulting disturbances when for any reason this structure has to be sacrificed, as it is of the utmost importance when we take up the study of this subject in the concrete. Were it not for the great importance of this structure, the clinical significance of our study would be reduced to a simple operative procedure. There would be nothing gained by the expenditure of time and energy in trying to differentiate between the infections of the various cells of the ethmoid or of the middle turbinate, for it would be easier to remove all of the turbinate together

with the nasal wall and trabeculae of the whole ethmoid. With our present knowledge, the most important thing is to ascertain, so far as possible, the degree and extent of the existing pathologic conditions, to learn of the duration of the disease and whether there have been previous attacks, to consider the inconvenience of the existing ethmoid disease to the patient, the degree of extension into other structures and the inconvenience as well as danger due to this extension. It is likewise of great importance to consider the patient's general condition, his hygienic surroundings, his habits and previous treatment, if any. After having gone over the individual case, unless we are sure that the whole ethmoid structure is beyond repair, I believe it is our duty to make the patient understand that it will give better results in his case to save all the nasal structures possible and tell him that in trying to obtain this final result several operations may be necessary. After this understanding, we should do only what we believe to be essential to accomplish the results and follow this up with suitable treatment, resorting to further operative interference if found necessary. We cannot make this point too strong because it is so easy to be led into extensive radical exenteration; and it is impossible to restore structures once removed or to overcome the symptoms frequently resulting from this extensive loss of tissue. In extensive ethmoid diseases it may be absolutely impossible to stop the progress or to give relief without thorough exenteration. When we are able to prove that we are dealing with such conditions it would be folly to attempt what would ordinarily be conservative treatment. The most thorough exenteration is none too radical and must be advised.

The ethmoid cells are intimately associated and are practically a part of the labyrinth of cells beginning anteriorly with the frontal and ending posteriorly with the sphenoid. Through their drainage they are also more or less intimately associated with the large

inferior orbital cell, the maxillary antrum. In dealing with the ethmoid cells—from an etiologic, a diagnostic, a prognostic and a therapeutic point of view—we have to consider carefully the frontal and sphenoid cells and also the maxillary antrum. The symptoms are frequently exaggerated by those arising from a coexisting frontal, sphenoid or maxillary disease, or they may be simulated by disease of these associated areas. Again, disease of the maxillary may be simulated or produced by the discharge of a diseased ethmoid into its cavity.

Irritation of associated nerve filaments, especially the dental, may produce symptoms of pain and sometimes hypersecretion of mucus within the nose which naturally suggests infection and may lead to a wrong diagnosis unless much care is exercised.

Clinically, we see a number of pathologic conditions within the ethmoid. These conditions vary in intensity and produce varying and various degrees of symptoms. These symptoms are not necessarily a guide to the severity of the pathologic process. The anatomy varies considerably and this variance is an important factor in the production of the symptoms and in the progress of the pathologic processes.

Although it is clinically impossible to classify satisfactorily the pathology of the ethmoid, for the purpose of more easily presenting the clinical aspect, we can first divide it into two classes, the purulent and the non-purulent. The purulent may be either acute or chronic. The non-purulent may occur as an acute inflammatory, a chronic inflammatory, a degenerative (polypoid and atrophic), a syphilitic, a tuberculous or a neoplastic. The purulent or non-purulent types may occur independently or may be associated. The acute inflammations are extremely common and are usually associated with attacks of acute general rhinitis. The majority are self-limited. They are often the most difficult to diagnose as the symptoms are frequently the only real guide, and when the drainage is not mate-

rially obstructed the symptoms may be so slight that the condition is overlooked. When there is associated purulent secretion which can be observed coming from some of the ostia, the diagnosis is easier and more positive, but more frequently the secretion if excessive is mostly serum and it is practically impossible to state positively from what area it is coming. It spreads out over the mucous membrane of the turbinates and fossae and discharges from the nose anteriorly or into the epipharynx posteriorly.

The symptoms in this condition are usually not severe until some of the channels of escape become blocked by the swollen mucous membrane. When there is a blocking of excessive secretion from the ethmoid cells there arises a sensation of fulness and heaviness within the head and there begins a more or less severe pressing pain which radiates from the eye and often extends into the temple, the parietal, and, sometimes into the postauricular areas. All the visible mucous membrane within the nose is usually infected and more or less swollen, as the results of the infective process usually spread over quite an extensive area.

The important objects to accomplish are first to relieve the distressing symptoms and to relieve pressure within the bony encased areas so that normal circulation may be established and the inherent vital forces given a chance to combat these infective elements and restore normal conditions as quickly as possible. The more rapidly and perfectly this takes place, the less liable is there to be a weakened resistance or a chronic termination. Though 70 per cent. or more of the acute inflammatory processes within the ethmoid cells are self-limited and result in cure without any interference, the knowledge that the others are liable to become chronic and may become extremely severe, producing not only local distress but also general infirmity, should make us very careful in studying and treating all the cases which come to our attention. It is important that the general condition of the

patient receive immediate and appropriate treatment. The gastrointestinal tract must receive attention and the patient should be protected from exposure and fatigue.

Locally, much can be gained from a diagnostic point of view by a systematic application of cocaine about the ostia which naturally drain the various accessory cells. In order to gain positive knowledge, it is advisable to use a very small cotton-tipped applicator saturated with 5 to 10 per cent. cocaine solution, and to carry this directly to the anterior portion of the middle fossa under the tip of the middle turbinate. The patient's head should be inclined forward. If after a few minutes the distressing symptoms are relieved we can reasonably assume that the principal cause of the trouble is the anterior portion of the ethmoidal labyrinth or within the frontal sinus. At least the main object of our research, the relief of the pressure and faulty drainage has been obtained, and if this can be maintained our patient is nearly always started on the road to recovery. If this first application gives only slight or no relief, the next application should be made at the posterior end of the middle fossa where the posterior cells are liable to communicate with the nose. After this procedure the floor of the nose can be anesthetized and a thorough endoscopic examination made.

In acute cases in which cocaine and epinephrin establish drainage and give relief to the symptoms, the local use of these with the addition of argyrol is usually sufficient to effect a recovery in a comparatively short time. There are cases with acute onset in which we cannot establish drainage and give relief by local application, and more radical interference may be necessary. These cases may be annoying as we realize the great necessity of preventing serious advance and destruction of tissue and the desirability of sacrificing as little of the nasal structure and function as possible.

If the site of the disturbance seems to be in the anterior group of cells, an excision of the extreme anterior portion of the middle turbinate may be advisable and the anterior internal wall of the bulla ethmoidalis may be removed. The temptation is to use the curet extensively within the spongy cells, but this must be resisted until such time as we are reasonably sure that it is absolutely necessary.

Chronic suppurations of the ethmoid vary much in degree and in severity of symptoms. The purulent secretion within the nose is frequently very annoying, and that which flows backward into the epipharynx and into the pharynx may be very distressing when profuse, and extremely disagreeable when it is retained and forms decomposing crusts. The irritation of the mucous membrane within the nasal chambers with the resulting swelling frequently impedes the passage of air. There is often pain over the bridge of the nose or radiating from the nose to the temporal region. There are at times disturbances within the orbit. Frequently the complications within the epipharynx and eustachian tube produce the only severe symptoms. Quite often there is more or less enlargement of the normal cellular spaces because of retention of hypersecretion, and frequently these cells become much distended. This is especially true of the middle turbinate. When the condition is at all advanced, the cystic turbinate obstructs the nasal passage and produces the symptoms due to obstruction. The chronically inflamed ethmoid when subjected to excessive pressure from retained secretion frequently becomes necrotic. If this necrosis happens to break down the cell walls so as to produce good drainage, the process is occasionally self-limited. This is not, however, the general course of events. There usually develops more or less profuse granulation-tissue which tends to retain the secretion, and unless aided by surgery the process slowly advances. In this condition the middle turbinate may become so cystic and enlarged as prac-

tically to fill the superior fossa and obscure from our direct or endoscopic inspection the middle and superior fossae of the nose. Pus may be seen in the groove about the turbinate, but it is impossible to determine its original source. Sometimes much can be gained by crushing the turbinate with forceps, as sufficient space may be gained to be able to inspect the middle as well as the superior fossa. When there is sufficient space to obtain a good endoscopic view we can frequently determine the extent and location of the disease. The increased space obtained by reduction of the turbinate may enable direct treatment and a cure may result with little sacrifice of tissue and slight, if any, loss of function. When there is extensive degeneration and necessarily much loss of structure we can hope for relief but not a restoration of a normally functioning nose.

Polypoid formation as well as the hypertrophic inflammatory processes may begin as very circumscribed conditions and without purulent manifestations. Polypoid formation may exist for years and become very extensive without becoming purulent. While examining the nose with the endoscope we not infrequently discover small polypi within the middle fossa under the middle turbinate which have given no symptoms and might cause none until they had become large enough to appear below the turbinate. So far as the ethmoid is concerned, the mucous polyp is practically a malignant manifestation. Unless there is thorough removal of the growth together with the adjacent structure, there is almost sure to be a return of the condition. Little can be expected from a simple snaring of the polypoid mass, and in advanced cases permanent relief can be hoped for only through a radical exenteration of the ethmoid.

Syphilitic disease of the ethmoid may at first appear as a simple acute or a subacute inflammatory process. Later it may give symptoms and show the signs of a purulent ethmoiditis. It is important in all ethmoid

disease to consider and estimate, if possible, the possibility of syphilitic infection. When there is a possibility of the ethmoiditis being due to syphilitic extension, surgical interference should never be resorted to until after thorough antisyphilitic medication.

Neoplasms of the ethmoid other than polypi are very rare, and when discovered are frequently beyond eradication. Whether of the sarcomatous or carcinomatous type they are usually friable and very vascular. Any soft vascular tumor within the nose should arouse suspicion and receive immediate attention.

The technic of the various operative procedures is so well known that it has not seemed necessary to consider the subject here. It is also very difficult to deal with this subject in a conservative manner without being misunderstood. In certain cases the most radical procedures are really conservative, and were it not for the importance of the surrounding and associated organs they should be made even more radical. It is so much easier to perform a radical operation than to be obliged to perform perhaps several less thorough ones that inasmuch as the radical measures sacrifice more of the physiologic functions it is our duty to refrain from great sacrifice of tissue unless we are reasonably sure that other so-called conservative measures will not suffice.

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PATHOLOGY OF THE ETHMOID LABYRINTH

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In this consideration of the pathology of the ethmoid I shall take up only some of the more common pathologic conditions which have come under my own observation and discuss the clinical symptoms by which these conditions can be recognized.

The most frequent pathologic condition involving the ethmoid labyrinth is acute catarrhal ethmoiditis. This develops as a frequent sequel to an acute coryza. The changes in the mucous membrane covering the ethmoid which are characteristic of this condition can often be observed by an examination of the middle meatus where the ethmoid labyrinth comes more or less clearly into view. In these cases, by inspection we can recognize along the under surface of the middle turbinated body, along the unciform process, and along the exposed surface of the bulla ethmoidalis, an edematous-like swelling of the mucous membrane. Occasionally we observe in this acute form of ethmoiditis the formation over the exposed part of the ethmoid of small mucous polypi, which tend to disappear spontaneously on the subsidence of the acute process.

The occurrence of acute catarrhal ethmoiditis can usually be recognized from the symptoms, which are the result chiefly of impaired ventilation and drainage of the ethmoid cells, occasioned by the swelling of the mucous membrane. The patient experiences a characteristic sense of pressure and fulness, or even of pain, between the eyes. There is a profuse discharge of mucous into the nose and, as a rule, a great deal of

sneezing. The latter symptom is more or less characteristic of impaired ventilation of the ethmoid and is perhaps the most characteristic symptom of the chronic hypertrophic form of ethmoiditis.

An occasional sequel of acute catarrhal ethmoiditis is the occurrence of a closure of an ethmoid cell, with retention of secretion, over a considerable period. It is associated with a sensation of fulness or pressure in the region of the ethmoid. Very often the condition is relieved, after it has existed for a few weeks, by the spontaneous discharge of a quantity of a lemon-yellow or straw-colored fluid from the nose. More rarely the condition persists as a chronic mucocele, with a gradual distention of the ethmoid cells, sometimes toward the nasal chamber, at other times toward the orbit, through the orbital plate of the ethmoid.

An acute purulent involvement of the ethmoid labyrinth, acute empyema, is not so common. In these cases the profuse discharge of pus into the nose may be associated with a great deal of pain, caused primarily by impaired drainage from the ethmoid cells. The result of the impaired drainage is the same in the acute empyema of the ethmoid as when this condition develops in acute empyema of the mastoid; the bony framework becomes involved. With the softening of the bony walls of the ethmoid there is likely to develop an extension into the orbit and, finally, an external fistula, which is usually located either just above or just below the inner canthus of the eye. When the ethmoid bone becomes involved in cases of acute empyema of the ethmoid the process is certain to persist as a chronic empyema unless the diseased bone is thoroughly removed by operation.

Of the chronic pathologic conditions involving the ethmoid, the most common and often the most troublesome form is chronic hypertrophic ethmoiditis. This is primarily a non-suppurative disease, but with the impaired drainage of the ethmoid cells, which the hypertrophy of the mucous membrane produces, the

condition may become the seat of a secondary suppuration which persists after an acute infection as a chronic empyema.

The first change that takes place in the hypertrophic form of ethmoiditis is in the mucous membrane, which undergoes a polypoid degeneration. This involves the mucous membrane lining the ethmoid cells, as well as the covering of the nasal wall of the ethmoid, especially the unciform process and the bulla ethmoidalis. Later, the ethmoid bone itself becomes involved. The changes in the bone are the result in part of reabsorption of the bone, and in part of newly formed bone, the former, as a rule, predominating. The symptoms by which the hypertrophic ethmoiditis can be recognized are quite characteristic. The patient complains of symptoms of almost continuous acute head cold, attacks of sneezing associated with profuse water discharge from the nose, sensation of fulness and pressure between the eyes, etc. A careful examination of the middle meatus is often necessary before one can detect the characteristic polypoid degeneration over the exposed surface of the ethmoid. It is not always possible to determine the extent of the process involving the ethmoid by the changes observed in the middle meatus. Very often one detects only a few small polypi under the middle turbinate, when an opening of the labyrinth discloses an extensive polypoid degeneration of the membrane lining the ethmoid cells. The hypertrophic form of ethmoiditis is not infrequently a part of a diffuse hypertrophic process involving the lower turbinate bones as well.

The chronic empyema of the ethmoid cells occurs usually as described above: first, by the persistence of an acute empyema, because of the involvement of the bony framework when the drainage has been seriously impaired; second, by an acute infection taking place in the presence of a hypertrophic ethmoiditis—here the impairment of drainage keeps up the process as a chronic empyema.

There is a chronic atrophic form of ethmoiditis seen, as a rule, in connection with a general atrophic process throughout the nose. In these cases, the atrophy apparently begins in the mucous membrane of the ethmoid, but, just as in the remainder of the nose, this atrophy is associated with atrophy and shrinking of the bony framework. This atrophic process is, as a rule, bilateral, but it is not uncommon to find the disease limited chiefly to one side of the nose. We see it developing on the side where a deflected septum has produced a roomy nasal passage, as well as on the more obstructed side. It is in these unilateral cases especially that we should suspect some circumscribed process, such as a focus of pus in the ethmoid labyrinth, as the cause of the atrophy. This conclusion is borne out by certain cases in which circumscribed suppuration of the ethmoid is associated with an area of atrophy restricted to the immediate region of the ethmoiditis. I have seen a circumscribed area of atrophy in the recessus spheno-ethmoidalis in which chronic empyema of the sphenoid was found unassociated with any involvement of the other nasal accessory sinuses.

The cystic enlargement of the middle turbinated body and of the bulla ethmoidalis are often described as pathologic conditions. While it is true that these structures may be the seat of a mucocele which is causing them to enlarge, the enlargement is usually in the nature of an anatomic variation. These variations are quite common in the formation of the ethmoid labyrinth. It is not unusual, for example, to find a large ethmoid cell developing in the floor of the frontal sinus, or for an unusually large cell to develop at the expense of the other ethmoid cells. The aberrant ethmoid cells which occasionally develop in the middle turbinated body may become the seat of a chronic inflammatory process, just as may any other ethmoid cells. In most of the cases of cystic enlargement of the middle turbinated body the cell is free from any secretion.

Tertiary syphilis not infrequently involves the ethmoid, with extensive bony necrosis. In these cases the orbit is usually sooner or later involved and an external fistula forms in the region of the inner canthus.

The development of a primary malignant growth in the ethmoid labyrinth is occasionally observed. The first symptoms in these cases are likely to be those produced by a secondary involvement of the orbit, while in the nose there may be relatively little to indicate the serious character of the disease.

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THE SURGERY OF THE ETHMOIDAL LABYRINTH

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The ethmoidal labyrinth is accessible to surgery by two routes, the intranasal and the external. The first route is in use almost daily, whereas the second is employed occasionally and generally as a part of the procedure known as the radical fronto-ethmoidal operation of Killian. As what I have to say concerns mostly the intranasal operation I will describe the external operation first and then after reviewing the applied anatomy of the ethmoidal labyrinth will devote the remainder of the paper to the intranasal methods of operating on the ethmoidal labyrinth.

THE EXTERNAL OPERATION ON THE ETHMOIDAL LABYRINTH

I usually operate with the patient in the half sitting position and with the posterior nares plugged. Many operators previously remove the middle turbinate under cocaine. As it will appear later, it is better not to do this. A curved incision is started at the inner end of the unshaven eyebrow and carried downward half-way between the inner canthus of the eye and the bridge of the nose. The skin incision having been carried to the bone, the nasal bone, except at the bridge and the ascending process of the superior maxilla, are freed of periosteum. Next the periosteum is to be freed from the inner wall of the orbit and the lacrimal sac turned from its bed. This is best accomplished by entering the orbit at its extreme upper angle, just inside the attachment of the pulley

of the superior oblique muscle. Cut straight down to the rim of the orbit through the soft tissues and begin the separation of the periosteum with the point of the knife. This accomplished, a small curet is placed in the incision and swept downward and backward. The procedure readily strips the periosteum from the lacrimal bone and the os planum and readily also turns the lacrimal sac from its bed. The periosteum should be freed from the inner wall of the orbit for two-thirds of the distance back or to the anterior ethmoidal artery, in other words, for a distance of about $1\frac{1}{2}$ inches from the bridge of the nose. The lacrimal sac should be turned from its bed until the bottom of the lacrimal groove stands out clearly. If the attempt is made to work from below upward, as I was accustomed to do for some years, and to loosen the lacrimal sac first, the curet often catches in the lacrimal groove and perforates into the nose. The lacrimal sac and the periosteum of the inner wall of the orbit and the globe of the eye are retracted outward and held in this position. The next step in the operation is the removal of the tip of the ascending process of the superior maxilla, the lacrimal bone and the anterior half of the os planum. I usually begin with the removal by chisel of the tip of the ascending process of the superior maxilla. This is hard bone, and unlike the nasal bone, does not splinter. It is removed flush with the bottom of the lacrimal groove. Then with a conchotome the inner half or two-thirds of the nasal bone is taken away. The bridge of the nose must be left intact for fear of a depression afterward. If the approach to the labyrinth is begun through the nasal bone as in the earlier technic, it is well to support the nasal bone by placing a thin strip of wood in the nose under it. Special chisels and the hand burr of Krause I have discarded. A motor-driven burr, however, for the removal of the tip of the ascending process of the superior maxilla, would be a great luxury.

A portion of the nasal bone and the tip of the ascending process of the superior maxilla having been removed, a thin conchotome is employed for the next step, which is the removal of the lacrimal bone and the anterior half of the os planum. The removal of bone as just described uncovers the ethmoidal labyrinth from the front and from the side. The operation is carried a step further by curetting backward and downward through the labyrinth until the front wall of the sphenoidal sinus is clearly exposed. The operator is guided in his manipulations by the middle turbinate on the inside and the os planum, or rather the posterior half of the os planum, on the outside. The operation is completed by the thorough removal of the middle turbinate and the superior turbinate. The scissors will remove the greater part of these, but the extreme upper portions are best removed with the conchotome. The middle turbinate is very elusive. It turns inward and lies snugly against the septum so that it has to be pried outward into the field by a probe placed in the olfactory slit or by a small curet. The summit of the olfactory groove can be taken as the upper surgical limit of the ethmoidal cells so that if the probe or curet placed in the groove and carried outward encounters the stump of the middle turbinate or the superior turbinate, this ridge should be removed with it and the cells which lie external to it. Probably no operator ever removes both middle and superior turbinates flush with the summit of the olfactory groove. The point that I wish to make is that in many instances the superior turbinate and cells adjacent to it are not removed because the operator has no guide by which to judge the extent of the previous removal of the cells.

Experience has taught me that the amount of overhang of the middle and the superior turbinate after the removal of the lower part of the middle turbinate and the exenteration of the main part of the labyrinth

is the best index of the amount of work done and to be done. The skin incision is closed. I usually pack the nose lightly with plugs covered with Cargile membrane for the first twelve hours. Many operators do not pack at all, maintaining that if the operation is thorough no packing is required. My experience has been that in the cases in which no packing was used, packing was necessary later to control hemorrhage. The objection to packing of course is that it tends to dam back the infected secretion and so favor infection of the meninges. The danger is a real one, so that if packing is used it should not be tight and should be kept in but a short time.

THE BALLINGER METHOD OF EXENTERATION OF THE LABYRINTH

In 1909 Ballenger introduced a right and left knife made on the principle of the spoke shave for the exenteration of the labyrinth *en bloc*. These knives work well, almost too well in some cases, and uncap the posterior two-thirds of the labyrinth nicely. Anteriorly, however, behind the ascending process of the superior maxilla they do not remove the cells thoroughly and must be supplemented at this point by the curet. Another objection to the knife, but one which is not very vital, is that it works from behind forward, the reverse of the logical order, and works in the dark and wholly by touch. Furthermore, unless the knife is held throughout its course absolutely true, the point is liable to perforate the upper part of the septum. This has happened twice to me, but in neither case was it of any importance later. If one will take the pains to master the use of this instrument I feel that he will resort to it in cases in which rapid work on the labyrinth is called for.

In 1908 Good published an article entitled "An Intranasal Method for Opening the Frontal Sinus and Establishing the Largest Possible Drainage." The

operation consists of four steps, the first two of which concern us here. The steps are as follows:

1. The removal of the middle turbinate.
2. The removal of the ethmoidal cells and the unciform process.
3. The removal by chisel of a portion of the upper inner surface of the ascending process of the superior maxilla and the separation of the median wall of the ethmoidal labyrinth at its attachment to the nasal spine.
4. Rasping away the lateral aspect of the frontal spine, thereby enlarging the space between the spine and the orbital wall.

Good accomplishes his first step, the removal of the middle turbinate, and a part of the second step, the opening of the labyrinth, by Ballenger's knife. He then proceeds in the following manner: He places a probe in the frontal sinus to act as a shield, and then with a chisel pries the unciform process inward. The loosened unciform process and the neighboring ethmoid cells are removed as thoroughly as possible with conchotome and curets. With the unciform process removed, he states that almost any diseased frontal sinus can be probed.

Worthington in 1909 stated that in fifty-nine cases it was possible after intranasal operating to enter the frontal sinus in 93 per cent. of the cases. He employed curets of his own pattern and a modification of Good's rasps. Skillern in his book on "Diseases of the Accessory Sinuses" states that in a series of skulls, considerably over 200 in number, it was possible to probe the frontal sinus after high removal of the anterior end of the middle turbinate.

These articles show that the operators were gradually systematizing the procedure which had been somewhat haphazard of entering the frontal sinus through the anterior part of the ethmoidal labyrinth. At least one of the German workers had done the same thing before any of the men mentioned above. For years

of course it has been a well-known clinical experience to gain the frontal sinus by operating on the anterior part of the ethmoidal labyrinth. I am not attempting a full bibliography, but am simply pointing out that for the past few years the procedure has gradually been assuming a more systematic form. In 1912 I read a paper on the applied anatomy of the ethmoidal labyrinth and in it elaborated a method of exenterating the ethmoidal labyrinth. After using the method for two years I find that I have but little to say beyond what I said then. I shall speak first of the applied anatomy and then of the operative manipulations which, it seems to me, naturally spring from it.

THE POSITION OF THE ETHMOIDAL LABYRINTH

The ethmoidal labyrinth is placed outside of the cribriform plate and rises an eighth of an inch above it. Posteriorly, the labyrinth is in part free in the nasal cavity and in part united to the front face of the sphenoidal sinus. Anteriorly, it is bounded by the posterior and inner surface of the ascending process of the superior maxilla and by the posterior surface of the internal angular process of the frontal bone. Its position in relation to the orbit, the antrum and the nasal cavity is too well known to call for review.

THE CLASSIFICATION OF THE ETHMOIDAL CELLS

The ethmoidal cells are divided into two groups by the attachment of the middle turbinate. The cells placed in front of this plane are classed as anterior, and those back of it as posterior cells. The attachment of the middle turbinate begins anteriorly in front of the unciform groove, roughly, about a third of the distance down the groove, and in the region of the ridge of the ascending process of the superior maxilla called the agger nasi. After bridging across the unciform groove the attachment of the middle turbinate slants directly downward, making an angle of 45 degrees with the front face of the sphenoidal sinus.

The upper third of the unciform groove is covered by the anterior part of the middle turbinate. The essential anterior cells are on this level.

THE GROUPING AND THE SIZE OF THE ETHMOIDAL CELLS

Three or four small cells radiate from the upper part of the unciform groove under cover of the middle turbinate. They suggest in their arrangement the tail-fins of a lobster. A third of the distance down the unciform groove, in front, and in the region of the agger nasi there is another cell, the agger nasi cell. There may be two cells in this locality. The posterior boundary of the unciform groove is the oblong sausage-like swelling of the ethmoidal bulla. This consists, as a rule, of two cells, an upper and a lower. The first or the upper cell is in close relationship with the cells which crown the unciform groove. This cell opens posteriorly into the groove of the ethmoidal bulla. The lower of the two cells in the bulla in most cases pierces the attachment of the middle turbinate and drains into the middle of the third meatus.

The third meatus in one-half of the cases is the highest and therefore the supreme meatus. It has three openings classed as upper, middle and lower. The middle opening, as has just been said, in most cases leads to a cell which makes the inferior part of the ethmoidal bulla. The upper opening leads to a cell which runs outward and expands on the os planum for its base and then runs upward to the roof of the ethmoidal labyrinth. The inferior opening leads to a cell which, like the upper cell, runs outward to the os planum and there expands and makes its base. Then, like the upper cell, it runs to the roof of the labyrinth and then extends backward to the front wall of the sphenoidal sinus, with the outer part of the anterior wall of which it unites, the outer part of the front face of the sphenoidal sinus and the posterior part of the ethmoidal labyrinth having in this way a common wall.

When a fourth meatus is present there is usually but one cell leading from it. This may monopolize the whole of the common wall with the sphenoidal sinus, or it may take a part and leave the rest for the lower cell of the third meatus. The posterior cell, which is in relationship with the front wall of the sphenoidal sinus, often sends a prolongation backward to the outside of the sinus, and at times this is larger than the sinus itself. There are some seven anterior cells, and they are small; there are three or four posterior cells, and they are much larger, especially the most posterior cell, than the anterior cells. It is not unusual to find one or two large posterior cells making up the whole posterior half of the labyrinth. The anterior and the posterior groups of cells are generally distinct, and the partition between them, the attachment of the middle turbinate, is thin and easily broken. I have encountered two instances in the dissecting-room and one instance in the living, a case which I saw with Dr. F. P. Emerson, in which the attachment of the middle turbinate was so strong that no force which one would be justified in using on the living would force a curet through it.

The most posterior ethmoidal cell is in relation not only with the front wall of the sphenoidal sinus, but with the optic nerve and the large veins from the orbit which empty into the cavernous sinus. For practical purposes this makes it in relation with the cavernous sinus itself.

THE LAMELLA OF THE BULLA

The lamella of the bulla represents the first complete partition of the ethmoid capsule and reaches from the pars orbitalis of the frontal bone to the capsular base as well as from the lateral nasal surface to the lamina papyracea. When the inferior portion on this lamella is opened, the lowest part of the ethmoid capsule is penetrated. The shape of this structure varies greatly in the normal individual; sometimes it is quite flat and inconspicuous, sometimes consid-

erably enlarged and very prominent. The largest and most constant ostium of the anterior ethmoid cells lies in the passage between this structure and the middle turbinate about in the center of the bulla.

The presence or absence of the nasofrontal duct is due to the position of this lamella. If the lamella of the bulla is situated far forward at its superior extremity it encroaches on the floor of the frontal sinus, causing the latter to become foreshortened. Under these circumstances a narrow passage is formed before the ostium is reached. The length and breadth of this duct depend entirely on the position of the bulla lamella. It is formed by the following structures: in front by the superior nasal spine, externally by the lamina papyracea, behind by the bulla lamella and internally by the external surface of the middle turbinate.¹

THE NASOFRONTAL DUCT

The conception which I had of the nasofrontal duct was that it consisted of a tube-like canal half an inch long. On examining the form of the duct, I was surprised to find that in very many cases—I cannot give the figures, because as yet my series is not large enough—there is no tube-like duct. The only place where it has this form is at the beginning, where it is made by the internal angular process of the frontal bone. At this point there is a definite bony ring. This at once, however, gives way to an antero-posterior slit, which is more like an ethmoidal cell or an irregular meatus. Ethmoidal cells often empty into this at its lowest part. There is a tubular duct only in those cases in which an ethmoidal cell is placed in front and makes its anterior wall. Such a cell is not uncommon, running up in front of the duct as its anterior wall and mounding forward into the inner side of the upper extremity of the ascending process of the superior maxilla.

1. Skillern, R. H.: *Accessory Sinuses of the Nose*, Philadelphia, J. B. Lippincott Company, 1913, p. 289.

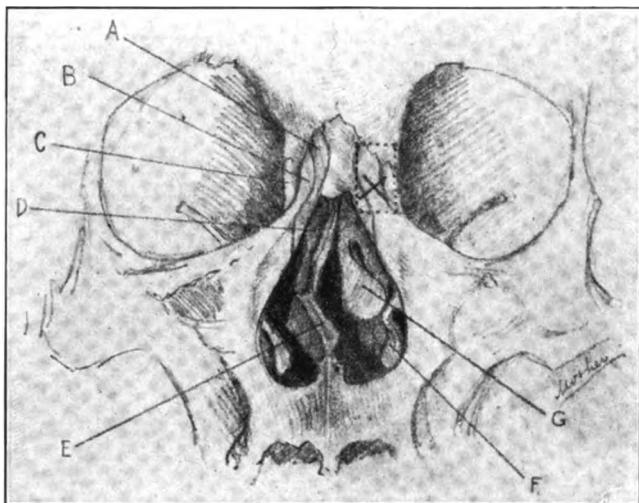


Fig. 1.—Relationship of the anterior end of the ethmoidal labyrinth to the middle turbinate, the tip of the ascending process of the superior maxilla, and the lacrimal bone. The position of the labyrinth is shown by the dotted lines; the cross shows the level at which the curet enters the labyrinth. *A*, nasal bone; *B*, ascending process, superior maxillary; *C*, lacrimal bone; *D*, middle turbinate; *E*, septum—marked deviation to right; *F*, inferior turbinate; *G*, middle turbinate, much enlarged.

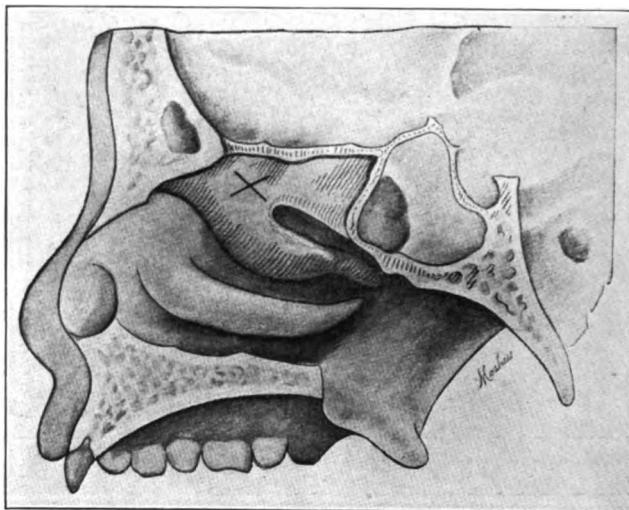


Fig. 2.—Drawing showing the middle and the superior turbinates. The cross indicates the point at which the curet is carried into the ethmoidal labyrinth. The portion of the middle turbinate below the summit of the third meatus is called in this paper the lower overhang, and the portion above and in front of this point, the upper overhang. The cross is placed on the upper overhang.

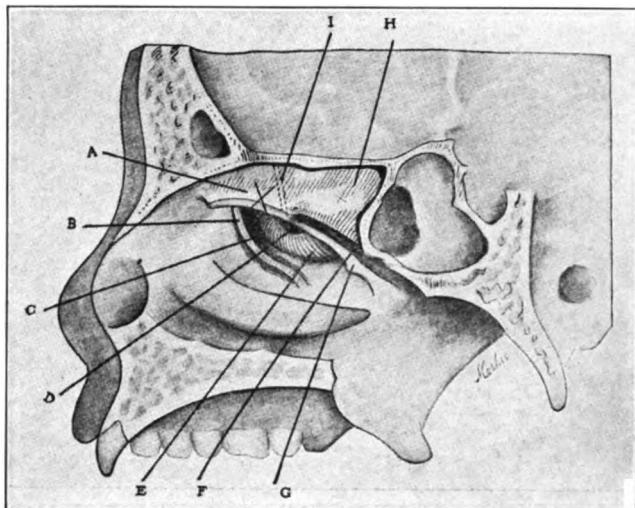


Fig. 3.—Drawing to show the anatomy of the nose after the middle turbinate has been removed in the usual manner. It is important to notice that the upper anterior part of the middle turbinate is still in place, and that this portion of the turbinate bridges over the upper part of the unciform groove. Removing the middle turbinate in this manner neither completely uncovers the anterior half of the ethmoidal labyrinth, nor opens it. The cross indicates the point at which the curet is carried into the labyrinth. *A*, upper anterior part of middle turbinate. *B*, unciform process. *C*, unciform groove. *D*, groove of ethmoidal bulla. *E*, ethmoidal bulla. *F*, third meatus. *G*, posterior attachment of middle turbinate. *H*, superior turbinate. *I*, upper part of attachment of middle turbinate.

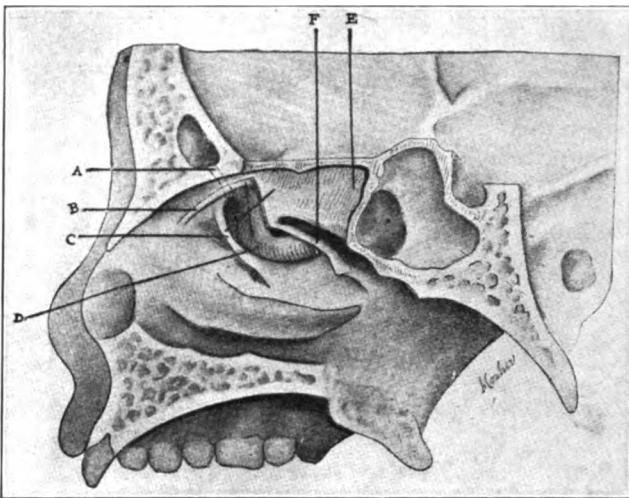


Fig. 4.—Drawing from a specimen in which the middle turbinate has been completely removed. By the removal of the upper overhang of the middle turbinate the anterior half of the labyrinth has been fully exposed. Compare this figure with the preceding one, in which the upper overhang of the middle turbinate is still in place. The usual operative procedure (Fig. 3) deals only with the lower overhang of the middle turbinate. The upper overhang (Fig. 4) is on a line with the superior turbinate and for practical purposes, continuous with it. In order to enter the ethmoidal labyrinth and to obliterate the nasofrontal duct, the curet must pierce the middle turbinate in the upper overhang and at the level of the superior turbinate. The cross indicates the place at which the curet is carried into the labyrinth. *A*, nasofrontal duct. *B*, attachment of middle turbinate. *C*, unciform process. *D*, ethmoidal bulla. *E*, superior turbinate. *F*, attachment of middle turbinate.

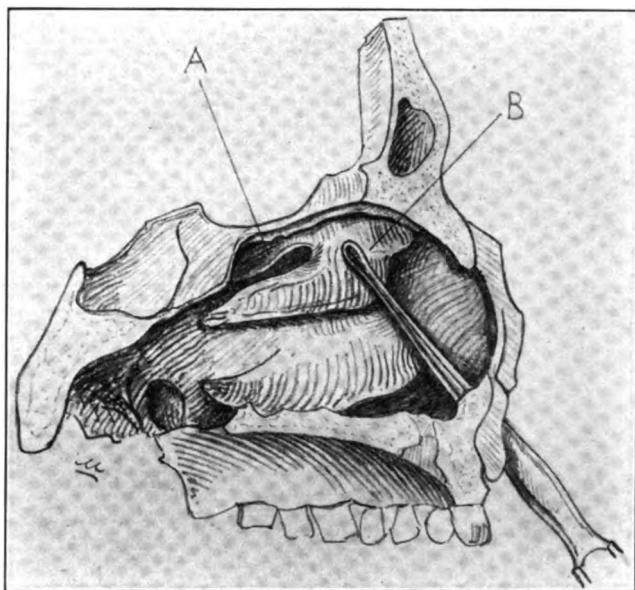


Fig. 5.—Curet placed against the upper overhand of the middle turbinate for the initial plunge into the labyrinth. *A*, superior turbinate; *B*, middle turbinate.

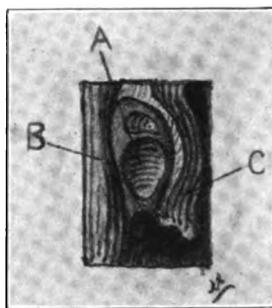


Fig. 6.—Anterior end of the ethmoidal labyrinth after the initial plunge has been made with the curet and the shattered part of the anterior portion of the middle turbinate has been removed with the conchotome. *A*, ethmoidal labyrinth opened; *B*, ascending process of superior maxilla; *C*, middle turbinate.



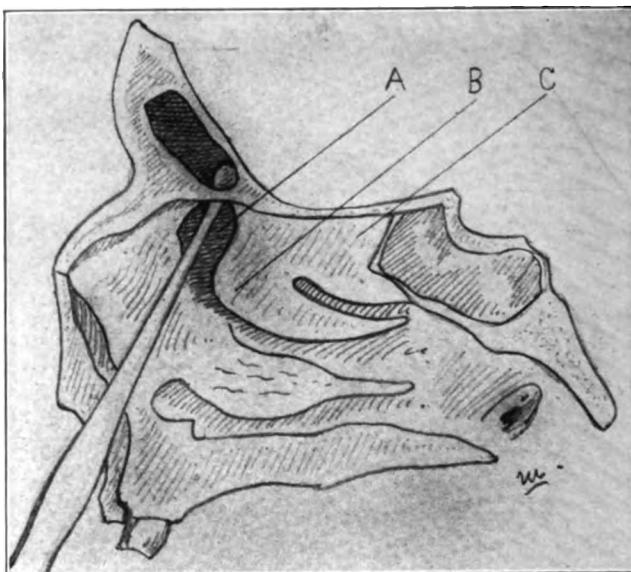


Fig. 7.—Curet passed upward through the exenterated part of the labyrinth. In this specimen the ostium of the nasofrontal duct was large enough to permit the curet to pass through it into the frontal sinus. The curet is stopped by the posterior wall of the sinus. The face of the curet is turned forward and outward preparatory to curetting forward, downward and outward. *A*, ethmoidal labyrinth; *B*, middle turbinate; *C*, superior turbinate.

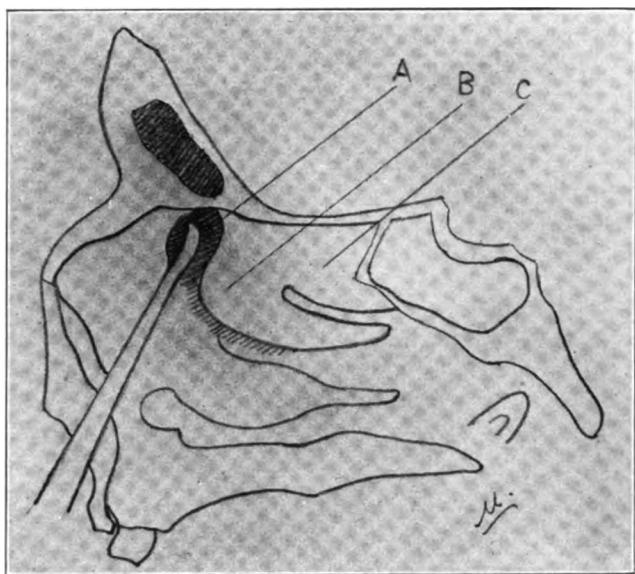


Fig. 8.—Position of the curet (face turned forward) in the act of curetting the posterior surface of the ascended process of the superior maxilla. *A*, ethmoidal labyrinth; *B*, middle turbinate; *C*, superior turbinate.

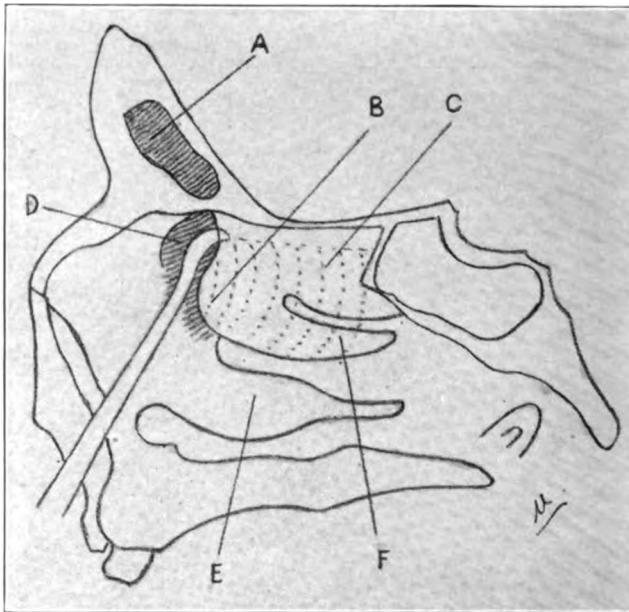


Fig. 9.—Method of curetting the posterior half of the ethmoidal labyrinth. The face of the curet is turned backward and pushed through the attachment of the middle turbinate, and then with a sawing movement, backward and downward, it is carried to the end of the labyrinth. The curved dotted lines show the various sweeps of the instrument. The curet is always kept outside the middle and superior turbinates. A, frontal sinus; B, middle turbinate; C, superior turbinate; D, anterior part of ethmoidal labyrinth opened; E, inferior turbinate; F, posterior end of middle turbinate.

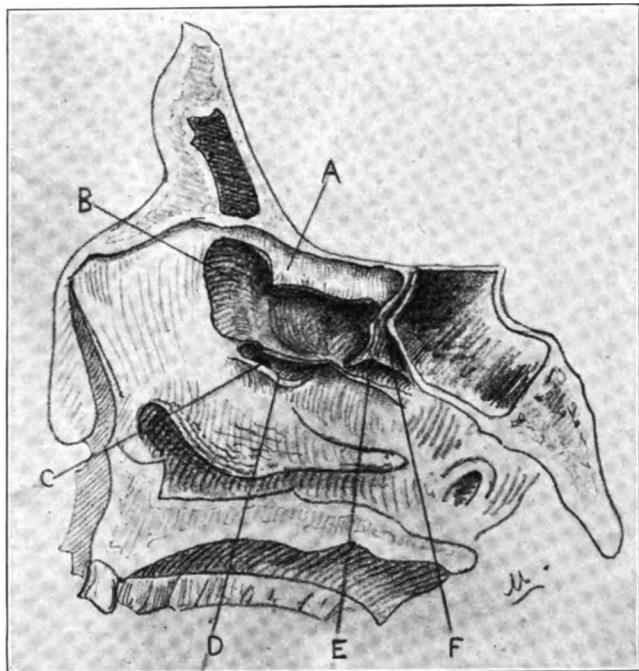


Fig. 10.—Anterior and posterior ethmoidal cells extirpated and the middle turbinate and part of the superior turbinate removed. The middle turbinate is removed with scissors or conchotome. *A*, superior turbinate; *B*, anterior part of ethmoidal labyrinth; *C*, ostium of antrum; *D*, unciform process; *E*, posterior part of attachment of middle turbinate; *F*, edge of posterior part of labyrinth.

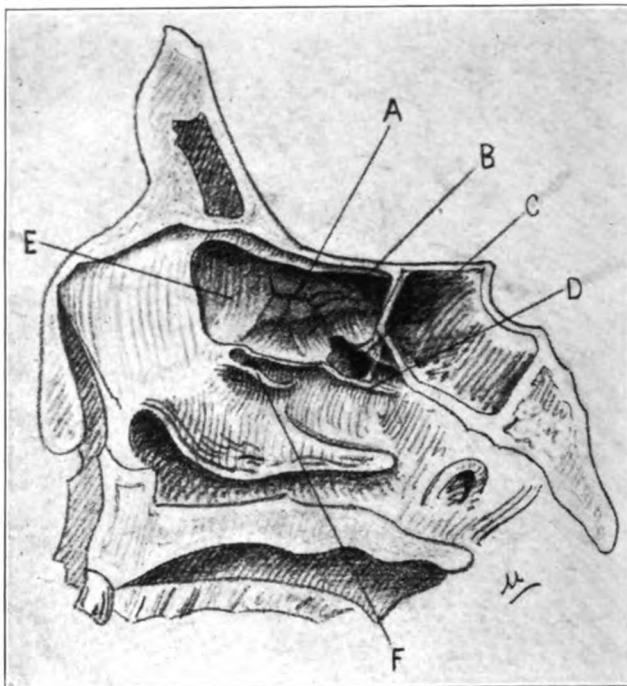


Fig. 11.—Removal by conchotome of the stump of the superior turbinate. In this specimen the ethmoidal labyrinth overhangs the antrum markedly and one posterior cell projects downward into the antrum. *A*, os planum; *B*, antral overhang; *C*, postethmoidal cell overhanging the antrum; *D*, posterior part of the attachment of the middle turbinate; *E*, anterior portion of ethmoidal labyrinth; *F*, unciform process.

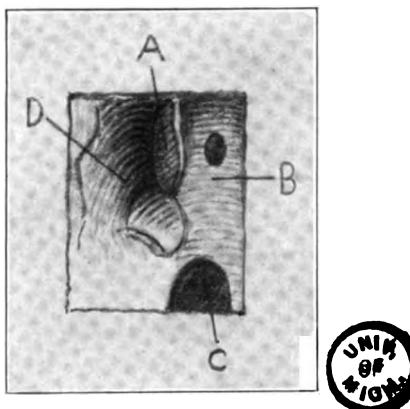


Fig. 12.—Anterior face of the sphenoidal sinus after the complete removal of the posterior ethmoidal cells. The two halves of this face are separated by the vertical attachment of the posterior part of the superior turbinate. In this specimen the attachment of the turbinate has not been removed flush with the face of the sinus. This should be done before the sphenoidal sinus is entered. *A*, attachment of superior turbinate; *B*, inner or nasal half of the front face of the sphenoidal sinus; *C*, choana; *D*, outer half of the front face of the sphenoidal sinus; there is a common wall between the ethmoidal labyrinth and the sphenoidal sinus.

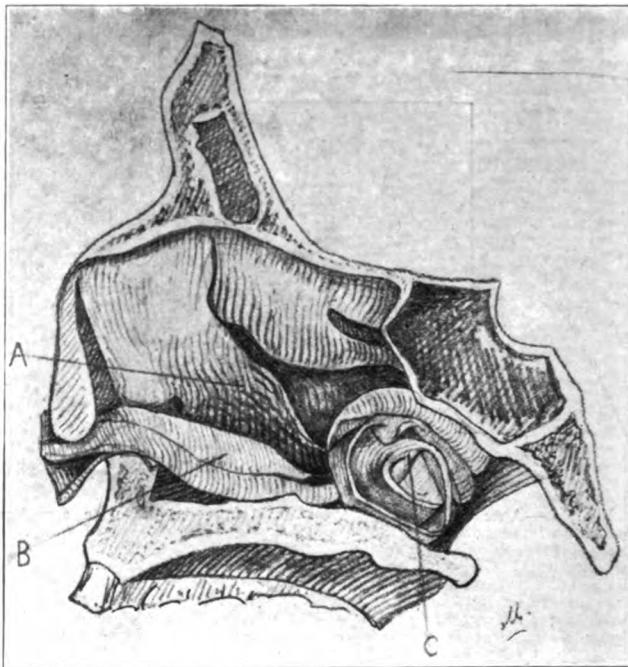


Fig. 13.—Method of blocking the choana by passing a folded strip of gauze along the floor of the nose and then twisting the end of it into a ball and crowding this into the choana. This leaves the greater part of the nasal chamber free from packing. *A*, inferior turbinate; *B*, strip of gauze; *C*, gauze rolled into a plug for the choana.

Where an anterior ethmoidal cell does not make the front wall of the duct, the duct, as I said, is slit-like, and more comparable to a cell or a meatus than to a duct. When this cell-like formation is present its inner wall is made by the anterior end of the extreme upper part of the middle turbinate. As far as my specimens show up to the present it is commoner to find a cell placed to the outside of the duct than in front of it. There may be two cells on the outside of the duct. It is less usual to find a cell on the inside of it. As a rule, the duct is nearer the middle turbinate than the lacrimal bone. However surrounded and related to the cells about it the duct may be, it tends to slant inward and to come into relationship with the inner surface on the anterior end of the middle turbinate. The duct, therefore, is easier to reach from the nose than from the orbit.

CATHETERIZING THE FRONTAL SINUS AND EXENTERATING THE ANTERIOR ETHMOIDAL CELLS

In order to catheterize the frontal sinus, the chin of the patient should be tipped up forcibly so that the operator can see the extreme portion of the anterior end of the middle turbinate and as much as possible of the superior turbinate. If the septum is deviated and obstructs the view, it can be forced to the middle line with a short Killian speculum. The point of attack is the agger nasi cell, if it is present and its mound can be recognized; if not, the upper part of the anterior end of the middle turbinate. The external guide to this point is the inner canthus of the eye. In the beginning it is useful to lay the curet on the side of the patient's nose and to measure off on it the distance from the inner canthus of the eye to the lower edge of the ala cartilaginea close to the cheek. A mastoid curet, with a long handle and a bowl about half a centimeter wide, is the most convenient instrument to work with. Having located the mound of the agger nasi cell, or, if it is not present, having brought into view the anterior end of the middle

turbinate, the curet is pushed upward into the olfactory cleft with the cutting edge outward and aimed and then pressed toward the lacrimal bone. If the curet is in the right place it easily enters the ethmoidal labyrinth. If it does not, it should be carried higher and a little farther backward. The common mistake is not to go high enough and far enough back. The curet has an allowable outward excursion varying with the labyrinth of half a centimeter to a centimeter and a half. If the curet is carried too far it enters the orbit. No harm results, except a slightly black eye which lasts a few days. If the operator puts the tip of his finger over the inner canthus he can readily detect the approach of the curet and if the manipulation is carried out delicately the resistance of the lacrimal bone can be felt. After the initial outward plunge the handle of the curet is brought into the median line and the head of the curet brought into line with the anteroposterior axis of the labyrinth. With the bowl up and the cutting edge downward, the curet is carried backward and downward until the bulla has been entered and destroyed. This means a backward excursion of half an inch. These manipulations leave the anterior end of the middle turbinate in shreds and dangling. This loose part is now cut off with a conchotome. The cutting surface of the curet is turned forward and a little outward and brought forward until the flint-like posterior edge of the ascending process of the superior maxilla is encountered. A few strokes of the curet leave this bare. When this has been done the anterior portion of the labyrinth stands open before the operator.

Experiments on the cadaver have shown that these manipulations are easily and quickly executed and that they exenterate the anterior ethmoidal cells and obliterate the nasofrontal duct, except for the bony ring where it leaves the frontal sinus. The operator can be sure that the opening of the nasofrontal duct is in the roof of the operative cavity thus made. Usually it is placed anteriorly and externally, and the

best guide to it is the posterior surface of the ascending process of the superior maxilla. If a probe carried upward and outward along the posterior surface of the ascending process of the superior maxilla does not drop into the frontal sinus, the probe should be carried farther backward and then brought forward still pointing outward. This procedure is necessary when an anterior ethmoidal cell makes the front wall of the nasofrontal duct. When present, such a cell is often broken down by the forward curetting. In a few cases it is necessary in order to find the duct to turn the end of the probe inward. If the probe is turned inward at the start there is danger of getting it caught in a cell on the inside of the tip of the ascending process of the superior maxilla, or in a similar cell placed a little higher up and mounding into the posterior part of the median partition of the frontal sinuses.

In order to enlarge the duct the head of the curet should be carried upward behind the ascending process of the superior maxilla until it brings up against the roof of the ethmoidal labyrinth, or if the duct is wide, against the posterior wall of the frontal sinus, where this slopes downward and backward over the orbit. A small curet will enter the posterior part of the sinus, and to carry it upward until it strikes the sloping roof of the sinus posteriorly produces a most uncanny feeling. A lateral roentgenogram gives the operator confidence in this matter, because from this by measurements he can get an idea of the slope and the height of the posterior wall of the sinus. In order to enlarge the duct, therefore, after the curet has been carried upward until it meets the resistance of the posterior wall of the sinus, the bowl is turned outward toward the orbit and brought forward and downward until it brings up against the ascending process of the superior maxilla.

If the purpose of the operator is simply to catheterize the frontal sinus and not to exenterate the anterior cells, the initial puncture is made through the anterior

part of the middle turbinate and the curet is brought forward until the posterior surface of the superior process of the superior maxilla is curetted free. Then the catheter is introduced. If the opening of the sinus is not readily found all the anterior cells must be exenterated.

Long before this some of you are wondering about the cribriform plate. The cribriform plate is the roof of the olfactory slit and is to the inside of the middle and superior turbinates. All of the manipulations which have been described so far, and are to be described later, are carried on to the outside of the cribriform plate and inside the ethmoidal labyrinth. The roof of the labyrinth is above and distinct from the cribriform plate.

In what way does this procedure differ from the customary one employed in catheterizing the frontal sinus? The plan which I have ordinarily followed was to remove the anterior end of the middle turbinate and then to fish upward and outward with a probe for the opening of the sinus. If this did not succeed I took a conchotome and bit away more or less at random the anterior cells which presented, and then tried the probe again. It should be remembered that removing the anterior end of the middle turbinate as it is usually done, does not open the labyrinth. In order to do this, the extreme upper and anterior part of the middle turbinate must be entered and the curet carried outward and behind the ascending process of the superior maxilla. Not to do this is simply to scratch the inner surface of the labyrinth, not to open it.

THE EXENTERATION OF THE POSTERIOR ETHMOIDAL CELLS

After the exenteration of the anterior ethmoidal cells it is only necessary to continue the curetting backward through the attachment of the middle turbinate in order to enter the posterior part of the labyrinth. Before the procedure is attempted it is of

the greatest importance to bring the head of the patient downward until the roof of the ethmoidal labyrinth is level. During the manipulations on the anterior cells the head of the patient was tipped strongly upward and backward, and there is a tendency on the part of the operator to leave the head in this position. To do this causes the operator to lose his orientation, and may, as has happened once, lead to disaster. Therefore, the moment the operator starts to enter the posterior part of the labyrinth, the head of the patient is brought level, and care is taken to keep it in this position for the rest of the operation.

Having, then, the head of the patient level, the operator plunges the curet through the attachment of the middle turbinate and works slowly backward and downward. In a majority of cases the moment the attachment of the middle turbinate is pierced the head of the curet enters a sizable cavity. This is due to the fact that the posterior cells are much larger than the anterior cells, and that one or two cells not infrequently comprise the whole posterior portion of the labyrinth. By this formation Nature has left but little for the curet to do. So roomy is the cavity into which the curet enters that the operator, feeling no bottom ahead, fears to carry the instrument onward. After the first case or two, when he has come to realize the large size of the posterior cells, the operator loses his natural timidity and quickly carries the curet to the posterior wall of the labyrinth. The feeling of relief that one experiences when the curet brings up against the posterior wall is much like that which comes to the tired and frightened swimmer when he reaches near enough to the shore for his feet to strike bottom.

The next step in the operation is the removal of the middle turbinate—that is, what is left of it, and the removal as well of the lower half of the superior turbinate. This is accomplished most easily by cutting straight backward as high above the middle turbinate

as the scissor-punch can be made to engage. One blade is placed in the exenterated labyrinth and the other follows backward in the olfactory slit. When the scissor-punch has cut its way to the front wall of the sphenoidal sinus, the middle turbinate and the lower part of the superior turbinate are removed with a snare, or are twisted out with a small pair of Luc forceps. If the operator prefers, the remaining portion of the middle turbinate and the required amount of the superior turbinate can be removed with a conchotome.

The final step in the operation is the complete uncovering of the front wall of the sphenoidal sinus and the recognition of the posterior ethmoidal cell. The hardest part of the operation is to recognize the limits of this cell. It is in this cell that he can get into the most trouble. Working in this cell, especially in its upper outer posterior angle, is the most dangerous part of the whole procedure. Experience has proved that it can be easily fatal to the patient if the operator loses his bearings in this locality. By carrying the curet backward to the outside of the middle turbinate it must of necessity bring up in this posterior cell. Trouble comes when the head of the patient is not held level so that the curet strikes the posterior wall at its extreme upper part. If it not only strikes the upper part of this cell, but also strikes it at the outer superior angle, it is easy to enter the cranial cavity, especially if the cell wall has been softened by polypi or pus. When, however, the head of the patient has been kept in the proper position, that is, level, the curet meets first the lower part of the posterior wall of this posterior cell. Owing to the bulging inward of the posterior part of the inner wall of the labyrinth, the front face of the sphenoidal sinus, where it is free in the upper and posterior part of the nasal cavity, is obscured until the posterior part of the superior turbinate has been removed flush with the face of the sinus. As soon as this important

manipulation has been executed, a very definite and characteristic picture is obtained. To the inside is the septum. Just outside of this comes the free or nasal face of the sphenoidal sinus. This is recognized by the presence of the ostium. Further out and limiting the front face of the sinus is the ridge which represents the attachment of the superior turbinate. Lastly, to the outside of this there is a depression made by the remaining portion of the posterior ethmoidal cell. Once this picture is obtained, however, it is necessary to follow up the removal of the superior turbinate absolutely to the front wall of the sinus. If the operator loses his orientation he can regain it, and he should regain it or abandon the operation, by finding the superior rim of the choana and then advancing upward with a probe close to the septum. No matter how narrow the inner or nasal part of the front wall of the sphenoidal sinus may be, this procedure will locate it. The wider the posterior cell the narrower is the free part of the front wall of the sinus. The inclination of the operator is to work too high and too far outward, and so to mistake the posterior wall of the posterior ethmoidal cell for the free or nasal wall of the sinus. Having made out the extent of the free wall of the sinus and likewise the extent of the posterior wall of the posterior ethmoidal cell, which is a wall common to the posterior cell and the outer half of the front face of the sinus, the operator selects the inner half of the front face and forces the curet through the ostium of the sinus into the cavity of the sphenoid. If the location of the ostium is not clear, the operator finds the upper rim of the choana and proceeds with his curet up the front wall of the sphenoid close to the septum. Presently the curet finds a thin place and enters the sinus. It seems to me dangerous to enter the sinus through the posterior wall of the posterior ethmoidal cell. When the ostium has been found and the cavity of the sinus entered, a probe bent at a right angle is introduced into the

sinus and turned outward and brought forward against the external part of the front face of the sinus and its width ascertained. This will show much of the anterior wall can be removed. With this information in mind, the operator introduces into the sinus a small, right-angular punch and bites outward, and downward, and inward, until all the thin bone of the front face of the sphenoidal sinus has been removed. The steps of the operation have now been completed. All that remains is to remove tags wherever they are found. It is not well to curet the superior outer angle of the posterior cell. The probe is even more dangerous in this region than the curet, because at this point the wall of the cell is thin. There has been one fatality from a probe entering the cranial cavity at this place. Not only can the probe enter the anterior fossa if used at this point, but it may encounter the ophthalmic veins as they merge with the cavernous sinus. Hitting these veins is practically the same thing as puncturing the sinus itself. As a finishing touch the curet is carried outward to the os planum posteriorly and brought forward along its inner surfaces. In my experience, the os planum is fairly resistant. Where there has been much suppuration there may be dehiscences.

SUMMARY

The anterior boundary of the ethmoidal labyrinth is made by the internal angular process of the frontal bone and the posterior surface of the ascending process of the superior maxilla. The labyrinth cannot be entered effectively unless the curet is carried outward behind the ascending process of the superior maxilla toward the lacrimal bone. Removing the anterior end of the middle turbinate and curetting upward, and not outward, does not open the labyrinth to any extent. The internal angular process of the frontal bone makes two-thirds or the whole of the bony ring, which is the first part of the nasofrontal duct. The best guide to the duct is the posterior surface of the ascending process of the superior maxilla.

In a large number of cases the nasofrontal duct is not a tubular canal, but consists first of a bony ring and then becomes a triangular anteroposterior slit. This is more like an ethmoidal cell or an irregular meatus than a duct. The nasofrontal duct tends to run from without inward and to come into relationship with the upper part of the anterior end of the middle turbinate. When the nasofrontal duct has the cell form the anterior end of the middle turbinate makes its inner boundary. The duct, therefore, is reached most easily through the nose, and through the anterior end of the middle turbinate. A curet introduced at this point and carried outward toward the lacrimal bone and then withdrawn a little and carried straight backward and downward enters the anterior part of the labyrinth behind the ascending process of the superior maxilla and breaks down the cells through which the nasofrontal duct runs, destroying both the cells and the duct. Very little curetting is required to convert the anterior part of the labyrinth into a single cavity. In the roof of this chamber, usually in the anterior outer angle, the opening of the nasofrontal duct is placed.

If it is the wish of the operator to clean out all the ethmoidal cells, the posterior half of the labyrinth is entered by piercing the attachment of the middle turbinate and by curetting still further backward, using all the while the outer side of the middle turbinate as a guide. If the head of the patient is held level, the middle turbinate guides the curet backward into the posterior ethmoidal cell. Often the posterior half of the labyrinth is a large cavity, made up of only one or two cells. This portion of the labyrinth has been, as it were, exenterated by nature. When the curet brings up against the back wall of the labyrinth the remaining part of the middle turbinate and the lower half of the superior turbinate are removed. Then the posterior part of the superior turbinate is taken away, flush with the front face of the sphenoidal sinus. The operator now recognizes the inner part

of the front face of the sphenoidal sinus, which is free in the nasal cavity, and the outer part, which has a common wall with the posterior ethmoidal cell. The posterior outer upper angle of the posterior ethmoidal cell is dangerous to curet or to probe. It is of the utmost importance that the operator should be sure of his landmarks in this locality. He orients himself by finding the upper rim of the choana and then differentiating the free face of the sphenoidal sinus by proceeding upward from the rim of the choana close to the septum. Having made out the extent of the free face of the sinus, the width of the common wall between the sphenoidal sinus and the posterior ethmoidal cell is determined. The dividing line between the two parts of the anterior face of the sphenoidal sinus is made by the obliquely vertical line, which is the attachment of the superior turbinate.

The usual mistake made by the operator is to get lost in the posterior ethmoidal cell—that is, he goes too high and too far outward, and considers the posterior wall of the posterior ethmoidal cell as the whole of the front face of the sphenoidal sinus. This mistake, if persisted in, will carry him into the brain. Insufficient removal of the posterior part of the superior turbinate and allowing the head to become tipped upward are the chief causes of this confusion. After the landmarks of the front face of the sphenoidal sinus have been cleared and recognized, the sinus is entered near the septum—if possible, through the ostium—and the whole of the anterior wall removed.

The mishaps of the operation are entering the orbit through the lacrimal bone and entering the posterior part of the anterior fossa of the cranial cavity at the apex of the orbit. The first accident is trivial; the second, fatal.

Puncture of the anterior end of the middle turbinate for catheterizing the frontal sinus or exentera-

tion of the anterior ethmoidal cells is readily accomplished under cocaine anesthesia. For the complete removal of the anterior and posterior cells, especially if this is to be accomplished at one sitting, it is more satisfactory to use a general anesthetic.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DR. HOLMES, SHAMBAUGH AND MOSHER

DR. ROSS HALL SKILLERN, Philadelphia: In 1909 when Uffernorde first brought out his work on the ethmoid he laid particular stress on the idiopathic, hyperplastic form. That is the form, of course, of polypoid degeneration and polyp formation. Previous to that time we considered that all polyps springing from the ethmoid region were due to some form of sinusitis, generally purulent, and when Uffernorde made that statement it was received with opposition by his German colleagues. It was taken up here, however, and now has come into general acceptance in Germany as well.

Uffernorde's classification really failed to bring out anything new. Twenty-five years ago Bosworth brought out a classification in which he mentioned this hyperplastic form. He divided ethmoiditis into six forms, and while some of these varieties were but different degrees of the same condition, nevertheless he anticipated Uffernorde in mentioning this distinctive form and so the priority belongs to an American. For operative purposes we can divide the condition of the ethmoiditis into the hyperplastic, the suppurative and a combination of these two. The hyperplastic may be extracapsular, the polyps being outside of the capsule without the cells being affected. The suppurative form may include one or more cells. As a rule, the suppurative ethmoiditis is limited to the anterior or posterior cells. Except in the atrophic form, suppurative ethmoiditis of the whole capsule is not frequently met. We may have a combination of these two forms, of course. The question has been raised whether the polyps cause the sinusitis or the sinusitis the polyps. It has been shown that when these conditions are in combination they are dependent on one another. There is an idiopathic form, in which pus never occurs, and again cases occur of the worst kind of purulent sinusitis in which polyps have never been seen.

This new operation has its place in certain conditions, the principal of which is when the middle turbinate lies close to the lateral wall of the nose, when it is going to be hard to infract the turbinate and get underneath it. Dr. Mosher short-circuits the whole thing. He makes a hole

in a definite place where certain things are to be found underneath. At present the way we operate on the ethmoidal labyrinth is first of all to attack the uncinate process which stands out in front of the ethmoid capsule, sometimes from 0.5 to 1.5 mm. We break that down with the hook; that gives us this extra distance. The bulla is directly in front and we can easily resect it. In the past in operating on the ethmoid we failed to have a sufficiently clear idea of just what we proposed to do when we started out. We should be in the same state of mind as the general surgeon when he starts an exploratory operation in the abdomen, for example. He opens the abdomen but doesn't know exactly what he is going to do. We say, "Well, we will go in and take out the polyps and make a nice clean passage," but we know they are going to return sooner or later. Now if we make up our minds when we begin that we are going to take out these polyps and see what is underneath, and if necessary continue further back, we will be doing a more satisfactory operation. If we have definitely in view that we are going as far as the indications warrant, we will do better work and get better results.

DR. OTTO FREER, Chicago: Deep hyperplastic ethmoiditis, as I have found it, is more inclined to involve the anterior ethmoidal cells than the posterior, but may include the entire ethmoid labyrinth. In marked cases the middle turbinated body and all of the cell-walls except a few remaining spiculae of bone are absorbed and the lateral mass of the ethmoid bone is replaced by polypi tightly packed in a space bounded outwardly by the orbital plate, above by the cranial plate over the ethmoid cells and internally by the nasal septum. In such extensive cases, not rare, Dr. Mosher's landmarks are lost, but nature furnishes a guide in the form of the polypi and softened bone, the operator knowing when he has reached the boundaries of the disease because his curet encounters firm, hard bone. I employ Grünwald's sharp spoons, the Grünwald punch with its wide mouth, and also ring curets, as the ring form cuts best. It is necessary to curet not only to the orbital plate but also forward and upward toward the frontal sinus, as the frontal cells (Killian) are nearly always involved, blocking the outlet of the frontal sinus, so that, after their removal, the operator nearly always finds himself in the frontal sinus and close under the cranial plate. After the operation a large cavity is seen above the lower turbinate with hard walls and free from polypi. A consideration of the anatomy of the region, as given by Dr. Mosher, will show how great the need of caution is in deep operations on the ethmoid bone. The dangers of the operation are penetration of the orbital plate, penetration of the cranial plate over the ethmoid cells and

entering the antrum of Highmore. The latter accident is usually without consequence, though acute maxillary sinusitis may occur. In two cases related to me by colleagues, penetration of the orbit was followed by blindness, the cause, in one case, being hemorrhage into the orbit; in the other, orbital abscess. To avoid such accidents the curets must be sharp so that they may be used without force and nothing must be done without the aid of sight. Working cautiously with curet and punch, and taking his time, the operator need not fear disaster.

DR. GEORGE F. CORR, Buffalo: Dr. Mosher's operation is one of the neatest, cleanest, best operations for draining the ethmoid cells that has ever been proposed. In latent sinusitis many pathologic conditions occur, producing great discomfort to the patient, as rhinorrhea, excessive sneezing, etc., with apparently no affection of the sinuses. That is in the latent stage, in which there is no pus, perhaps no mucopurulent discharge, but if the cells are opened and cleaned out often almost immediate relief is obtained.

DR. W. W. CARTER, New York: I do not think we should ever operate in acute ethmoid inflammation unless there is distinct evidence of pus under pressure. With regard to chronic purulent discharge, we all know from the structure of the cells, the position of their ostia, that it is impossible for them to drain thoroughly unless an opening is made into them. The real indication for operation on the ethmoid should depend on the condition of the bony walls of these cells. It has been shown that one of the earliest changes in polypoid degeneration occurs in the vascular layer of the periosteum, that it is a passive hyperemia, producing an edema. The condition, therefore, of the bone is a pathologic one, and if the bone is diseased you must remove it. Therefore polypoid degeneration is a definite indication for extirpation. Since the introduction of the Mosher operation I have used it a number of times and have had excellent results. It has given me a confidence in operating in this region that I never had before.

DR. F. W. SEARS, Syracuse, N. Y.: I speak from the patient's point of view. I suffered for years from ethmoiditis, which had finally resulted in severe attacks of asthma. A number of operations were performed with practically no benefit. Finally a Baltimore specialist attempted to relieve the trouble by an operation under a local anesthetic, which did not relieve the ethmoiditis. The asthmatic conditions came on worse than ever during the following October. At that time Dr. Mosher, after having several roentgenograms taken, operated under a general anesthetic. I believe the anxiety and suffering from local anesthesia more than offsets the discomforts and dangers from a general anesthetic. The operation resulted in a complete relief from the asthmatic conditions and a rapid restoration to health.

DR. A. L. BURDICK, Lansing, Mich.: I was impressed by Dr. Shambaugh's remark in which he compared the ethmoid to the mastoid labyrinth. I do not know why this is not oftener done. I was called to see a patient who had fever and intense pain, and exophthalmos of the left eye. There was a history of chronic nasal discharge for fifteen years. On examination the condition was undoubtedly one of purulent ethmoiditis. Four hours later I operated and removed literally sacs of pus, the sacs made up of the lining of the ethmoid cells. After three hours the pain was gone and the patient was practically well. Of course in this case there was abscess of the orbit, but it was not followed by blindness.

DR. G. W. MACKENZIE, Philadelphia: We may classify the condition into different types, but there are all grades of these different types and every case becomes individual. Conservative treatment is important for that reason. A patient came to me who had been operated on on the right side of the nose for frontal sinusitis, accompanied by maxillary sphenoiditis and more or less ethmoidal disease. It was on the concave side where there was a considerable deflection of the septum. I washed out each of these cavities and could find no involvement of the cells at this time. The patient, however, had an accumulation of mucopurulent secretion over the posterior part of the septum and more or less on the lateral wall. I cleansed it thoroughly and inspected the parts with the Holmes endoscope, which is advantageous in examining that region. After having assured myself by these methods that nothing was present, I sent the patient to two roentgenologists who made various roentgenograms, none of which showed positive indications of sinusitis. I then tried the experiment of plugging the right side of the nose with cotton sufficiently to filter the air breathed in this wide-open side. The patient reported the next day saying that he had no secretion. I tried the experiment several times and have since tried it in other cases, and I find that when there is sinus disease, on removing the cotton there is a jelly-like secretion and when no sinus disease exists there is practically no secretion. This led me in this case to do a septal operation with most favorable results.

DR. CHARLES R. C. BORDEN, Boston: I emphasize an important point made by Dr. Holmes. The second turbinate is a valuable structure and should be preserved as much as possible. In the early cases it is possible to save a considerable portion of it. Removing the anterior ends of the turbinate is poor surgery if it can be avoided. In cases in which simple drainage is desired I perform a modification of the Mosher operation, using a biting forceps in place of

a curet. I have had several unfortunate complications following the use of a curet and consider it a dangerous instrument. It is a comparatively safe and simple procedure to open the anterior ethmoid cells at Mosher's point of election with a biting forceps, making a long narrow pathway through the body of the ethmoid until normal bone is reached. A little force is required to make the first bite, but after the cells are reached they cut away with surprising ease. One is often amazed at the large number of small polypi which will come away in the mouth of the forceps when none were suspected of being present. The curet usually fails in this respect, as that instrument simply pushes the polypi aside. Of course, in advanced cases, this method of procedure will not be sufficient. In the early cases, however, it not only provides the desired drainage, but removes the polypoid tissue and at the same time leaves a considerable amount of healthy tissue in place, which is desirable for the welfare and comfort of the patient. In the advanced cases I perform the Mosher operation using both biting forceps and the curet as it is practically impossible to use the forceps alone. I have known several cases of meningitis to follow operations and great care is needed in doing them with any form of an instrument.

DR. JOHN O. ROE, Rochester, N. Y.: After listening to Drs. Holmes, Shambaugh and Mosher, one would naturally get the impression that operations on the ethmoid sinuses are simple procedures and that to enter the ethmoid sinuses and curet or cut away diseased tissues is comparatively free from danger. I therefore call attention to some of the dangers connected with these operations, especially in the hands of amateurs. Recently two deaths occurred in Rochester following nasal operations. These deaths, however, are not the only ones to be referred to, for the report of cerebral complications in nasal surgery are too frequent to be reassuring to the amateur, and it is only by those experienced in this line of work that such operations should be undertaken. I agree with Dr. Borden as to the advantage of biting forceps over the curet in many cases. When the walls of the ethmoid cells are quite thin and more or less fragile, the curet has its advantages, but in cases of more rigid walls, I have found the biting forceps much superior. For the anterior ethmoid cells I use the straight biting forceps, similar to those mentioned by Dr. Borden, but for entering the posterior ethmoid cells, I use forceps that I have had made, with cutting blades set at right angles to the shaft of the forceps, which I have previously described. In many of these cases, we find marked enlargement of the turbinal cells of the middle turbinate body, completely blocking the central portion of the nasal fossae. In dealing with these cells, I first determine their presence and extent by

puncturing them at their anterior portion with a slender bistoury. In a large majority of cases, the knife will enter the cells freely, indicating at once the nature of the conditions we have to deal with. With the straight forceps the outer wall of these cells is taken away, then by fracturing and forcing outward the inner wall, the nasal passage at this point is made free, while at the same time a mucous membrane forming a covering for this outer wall, is preserved. Before entering the posterior cells with the rectangular forceps, or even with the curet, it is of the utmost importance to locate carefully the posterior wall of the nasal passage, particularly in the region of the cribriform plate. This I do with a slender flat probe, made of steel, the distal end 4.5 mm. wide and very thin. It will go where the round probe will not, and with it the exact location and condition of the parts can readily be determined. This little instrument I have found so exceedingly serviceable in all such work, that I have dubbed it "my long finger."

DR. H. WILSON, Detroit: If I do not err in my understanding of the essential nature of Dr. Mosher's operation, the use of biting forceps in extirpating the ethmoid labyrinth goes aside from the spirit of the operation itself. I recall no other nasal operation which is exactly the same as Dr. Mosher's. It depends for its success on the ability of the operator to visualize the anatomic and pathologic conditions that exist at the end of his curet. Without this, one cannot properly execute the operation. The ability that we possess to translate the impression we receive from biting forceps fails to meet the requirements of the operation. It seems to me, however, that that is the crux of the operation itself; that is what makes it different from all other ethmoidal operations. It begins at a different point and we know our landmarks from that point on. As to the serious results spoken of, no one has a right to perform such an operation who has not acquired this power of visualizing the anatomic structures he is engaged in operating on. Failure to be able to do this may be the cause of the unfortunate results that Dr. Roe and others have referred to.

DR. JOSEPH C. BECK, Chicago: It is important to amplify the gross pathology of ethmoiditis. The names of three men should be mentioned in referring to the pathology of ethmoiditis—Woakes, Uffernorde and Wright. Last year I presented at the meeting of the Laryngological, Otological and Rhinological Society the subject of the histology of ethmoiditis, in which I showed the varieties I had found in my own practice. The bone and periosteum show the greater change, except in the acute cases. There is a distinct difference between polypoid and inflammatory edema of the mucous membrane and it will make a great difference in the results of operation. In the hyperplastic form, imperfection of the

bone and periosteum are essential points in the pathology, not secondary changes from infection; it is a degenerative process. It would be well for men to study their clinical cases and make a few sections showing where the disease is in individual cases. Two years ago this operation was demonstrated to me by Dr. Mosher. I went home and tried it on one side, the old method on the other. Now I use no method but his. If some one comes and tells us of blindness occurring in a certain case, thus putting a damper on such an operation, we should know who such operators are. It should not frighten expert men away from doing a good operation.

DR. LEE M. HURD, New York: Sometimes instead of the papery shell-like bone of the ethmoid we find it very thick, from 1 to 1.5 mm. of hard bone. In one case I could not get through. We find necrosis of the bone of the ethmoid cells of a non-specific nature at times and we do not get the condition well unless we exenterate the entire labyrinth. Taking out the polyps alone is like cutting the heads off dandelions. To get a cure we must do an exenteration. How does Dr. Mosher get at the prolongations of cells over the orbit? A straight curet will not reach these. I have been injecting Beck's paste into any remaining cells that cannot be reached at the operation and it seems to aid.

DR. E. M. HOLMES, Boston: I do not want to give the impression that I am opposed to operative procedures in the treatment of ethmoiditis. I thoroughly appreciate the work of Drs. Mosher and Skillern and others and am glad to see this operative improvement, but my paper was as I said, conservative, because we are seeing so much operative work, extensive exenteration, by men who are new at the work and who have not had sufficient experience. It is much easier for them to sacrifice all the structures in the nose than properly to study the case. All tissue which can be should be saved so that all the functions possible may be conserved. We all find cases in which polypoid degeneration extends to the upper and outer wall of the ethmoid cavity, even after thorough operation. It may be our duty even to remove a portion of the orbital plate.

DR. GEORGE E. SHAMBAUGH, Chicago: Perhaps the most interesting pathologic condition involving the ethmoid labyrinth is the condition first described by Woakes, which we now recognize as the non-suppurative hyperplastic ethmoiditis. It is often the most difficult to recognize and is the cause of the most troublesome and, in a way, the most interesting symptom. It is this form which is often associated with asthma. The early symptoms are those of recurring acute head colds, sneezing attacks, etc. I received a shock some years ago when Dr. Bosworth described his method of curing recurring acute head colds. He stood

behind the patient and with an electric burr reamed out the ethmoid labyrinth. We now recognize that he was operating for the relief of symptoms caused by hypertrophic ethmoiditis. We are doing the same thing now, only not quite in the same way. The one thing most essential in operation on the ethmoid is that the operator have a clear conception of the anatomy of this region. Unless he understands this thoroughly he has no business operating. To my mind not the least important part of Dr. Mosher's work has been to get our men interested in acquiring a better knowledge of the anatomy of this region. I am accustomed, when operating on the ethmoid, to do the work under local anesthesia. I usually remove a part or the whole of the middle turbinated body; then with a Hartman nasal forceps I begin in front and break through one cell after another until the whole labyrinth has been exenterated. The work with the forceps requires but a few seconds to complete. If one direct the pressure outward, backward and upward, one keeps clear of the cribriform plate. For this reason I like to leave standing the mesial wall of the labyrinth. The roof of the ethmoid labyrinth is a firm bone, whereas the cribriform plate is very fragile.

DR. HARRIS P. MOSHER, Boston: We have many good methods of getting into the ethmoid, but we want, more than anything else, a better idea of the pathology of ethmoiditis. I have found that non-success in getting into the labyrinth easily in this way is often because the curet is not placed high enough up or far enough back. Dr. Skillern says go as far as the pathology in the particular case warrants. That is the right idea. Dr. Freer said that in many cases of degenerative process there are no landmarks; that they have been destroyed. Of course that is true, but if one has a systematic procedure to follow one will not be in danger. As to the use of biting forceps rather than the curet, I prefer the curet until I find out where I am, and then I use the biting forceps. I use it freely after I have secured orientation with the curet. As to the serious results spoken of, anyone who does work on the ethmoidal labyrinth without a proper anatomic and surgical preparation simply has no surgical conscience. I agree with Dr. Wilson that to be able to visualize the operation is the main thing. After getting one's bearings with the curet the biting forceps or any other instrument may be used. As to Dr. Hurd's question about the cells that extend out over the orbit, they are, as he says, difficult to reach; I simply do with them the best I can. Dr. Shambaugh says he leaves the middle turbinate. I use the middle turbinate as a landmark to keep me in the labyrinth and to keep me away from the olfactory fissure. Then when I have cleaned out the labyrinth I remove the middle turbinate to free the front face of the sphenoid.

INTUBATION APPARATUS AND TUBES FOR TREATMENT OF CHRONIC STENOSIS OF THE LARYNX

HENRY LOWNDES LYNNAH, M.D., NEW YORK

An endeavor was made in the construction of this speculum to follow as closely as possible the mechanism of the bivalve vaginal speculum.

The intubation speculum (Fig. 1 *A*) is made with an adjustable "duck bill" tooth plate. The upper blade can be raised or lowered to accommodate the size of the mouth in which it is to be used, while the lower blade is nothing more than a wide tongue depressor.

The upper blade is made of brass in order to allow for leverage and avoid fracturing the incisor teeth, while the lower blade, being almost flat, is made of steel to avoid bending.

The upper blade is reflected over the side of the handle of the speculum and carried downward and inward, and is reenforced by a steel plate.

The arm of the lever is slotted and attached to the side of the handle by the adjustable screw lock.

In the lower portion which winds about the handle there is also a slot through which passes a fixed post threaded for the swivel wheel which not only when closing makes the tooth plate describe an arc of a circle in opening but at the same time permanently locks the same so that the mouth cannot be closed.

The spatulas are made interchangeable so that an infant or adult spatula (Fig. 1 *B*) may be readily attached to the universal handle. The spatulas also have double light carriers or a light suction carrier for those who wish to use suction. The tubes for the double lights make a railroad track which keeps the tube on introduction in the median line.

The introducer-extractor (Fig. 2) is made with an upward tilt so that the tube engages the larynx easily. Obturators are dispensed with, for the obturator is necessary only when intubation is performed at a right angle to the larynx, that is, in the "blind," or indirect method.

The dilating tubes are of "cigar shape" and dilate antero-posteriorly as well as laterally and are made with and without built-up heads. They increase 1 mm. in size over the O'Dwyer tubes up to 5 mm., made in five sizes.

The narrow neck tubes (Fig. 3 *A* and *B*) have a very small lumen and are made with a dilating body and built-up head. The lumen is too small to allow for free passage of air; therefore I have discarded their use and resorted to a more satisfactory method.

The abductor tubes (Fig. 3 *C*) are made in three sizes, with wide lateral heads but short in the anteroposterior diameter. These tubes have the posterior portion of the lumen and head cut out to allow for play of the abductors and arytenoid cartilages. By the use of these tubes reeducation of the muscle is possible and the spasm of the abductors can be overcome.

The dilating tracheal tubes (Fig. 3 *D*) are used when there is a low tracheal fistula with hypertrophy of the posterior tracheal wall. They are made in three sizes, 1 to 3 mm. increase in diameter.

The non-cough-up tubes (Fig. 3 *E* and *F*) have a low bulbous extremity which holds in the trachea. I have been using these tubes for the past four years, and so far in over three hundred cough-up cases not a single one has been coughed out after introduction. These tubes have put a stop to much of the anxiety which accompanies intubation.

The post tube (Fig. 3 *G*) has a device which can be screwed into the tube through the tracheal fistula. The tube is first introduced and scratched through the wound so that the scratch mark corresponds to the tracheal fistula, then it is removed and a thread hole bored to accommodate the post.

The bridge tube (Fig. 3 *H* and *I*) I have employed after laryngofissure. The tube is introduced through the mouth, and when in position the bridge is attached to it. Strips of adhesive plaster cross this bridge and are strapped tightly to the sides of the neck to make posterior pressure, so that the anterior fissure would heal primarily. I have discarded their use as I have resorted to dilatation only during the past five years.

Low tracheal and bronchial tubes are used only in low tracheal and bronchial diphtheria. I have been using them for the past year and so far have had gratifying results.

The tunneled sound with obturator is employed in tracheal cannula cases when it is necessary to dilate the larynx above the cannula. The sound is tunneled so that the patient can get air during the process of dilatation. These are made from urethral sounds. After dilatation has been accomplished this tunneled sound is passed, the tube attached to the obturator and intubation performed. All of these tubes and apparatus are made by George Ermold of New York.

24 West Fifty-Ninth Street.

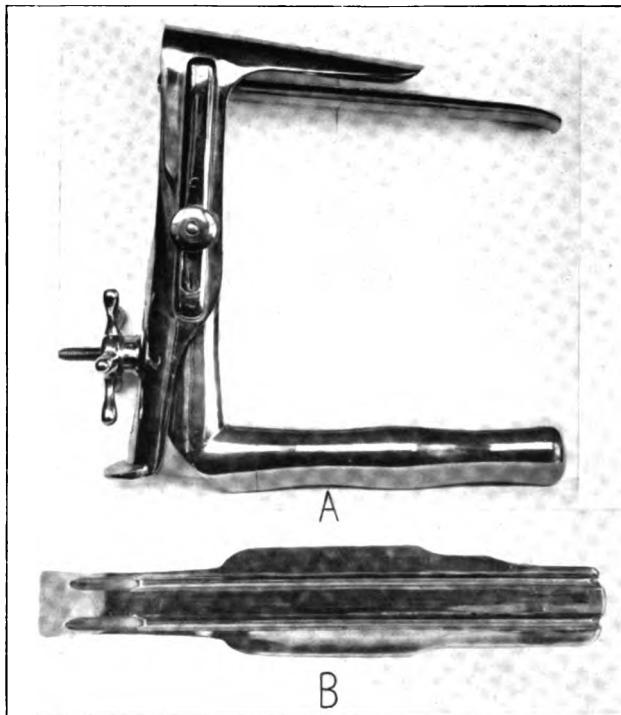


Fig. 1.—*A*, intubation speculum, showing spatula for children; *B*, adult spatula tongue depressor, lateral view, showing double light carrier.

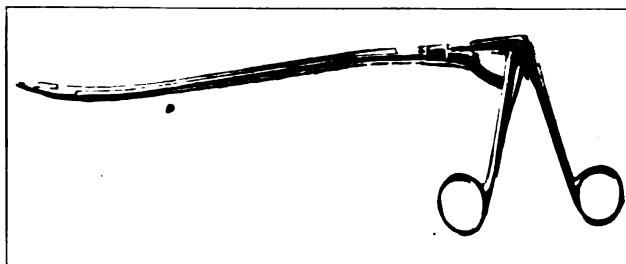


Fig. 2.—The introducer-extractor.



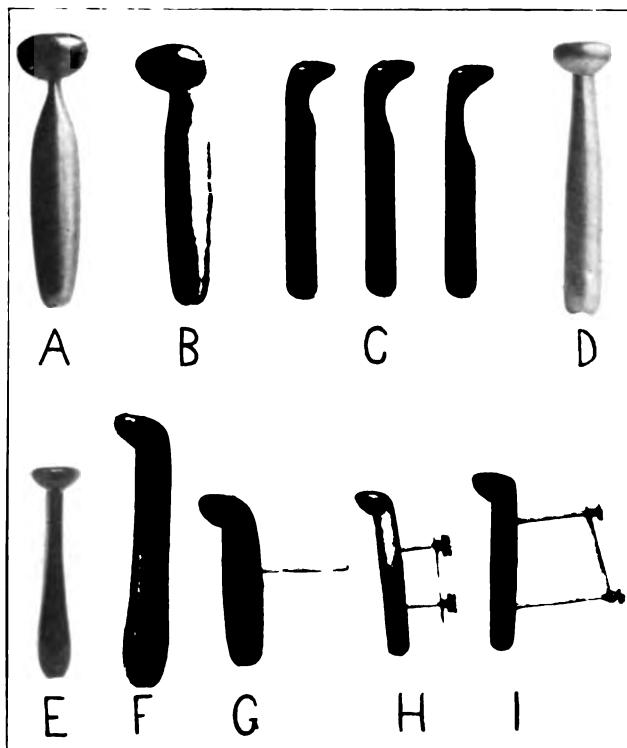


Fig. 3.—*A*, narrow neck dilating tube, lateral view; *B*, narrow neck dilating tube, anteroposterior view; *C*, abductor tubes; *D*, low tracheal dilating tube; *E*, non-cough-out tube, lateral view; *F*, non-cough-out tube, posterior view; *G*, *H*, *I*, post and bridge tubes, all dilating.

AN INSTRUMENT FOR HOLDING THE SEPTAL
MEMBRANES IN APPPOSITION AFTER SUB-
MUCOUS RESECTION, OBVIATING THE
USE OF PACKING *

LEE M. HURD, M.D., NEW YORK

The principle is to hold the septal membranes in apposition with German silver plates which are oblong, having diameters, 12 mm. wide and 15 mm. long. The male plate has a sharp tongue $5\frac{1}{2}$ mm. long. The female plate has a hole through which this tongue passes, the tongue being clamped over on the outside of the female plate.

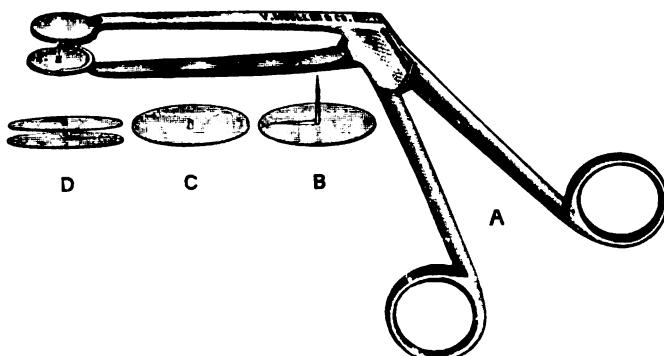


Fig. 1.—*A*, the introducing forceps. *B*, the plate with spike. *C*, the plate with hole. *D*, the two plates combined.

The instrument for introducing the plates has an overhang on the posterior half of its jaws, which holds the plates in place with the aid of some cohesive like vaseline. This overhang also prevents the plates from being clamped too tightly, thereby preventing sloughing from pressure on the septal membrane. The instrument, loaded with the plates, is introduced into the nares after the submucous resection, one blade being passed into each naris, having the jaw of the male blade under the guidance of the eye, the other blade taking care of itself.

* Instruments made by V. Mueller & Company, Chicago.

The introducing can be greatly facilitated by using a long-bladed, submucous speculum, such as mine, to keep the septal membrane away from the point of the male plate. The instrument should always be steadily pushed to the point where the plates are to be placed. Never recede, as this might displace the plates and cause them to fail in clamping together.

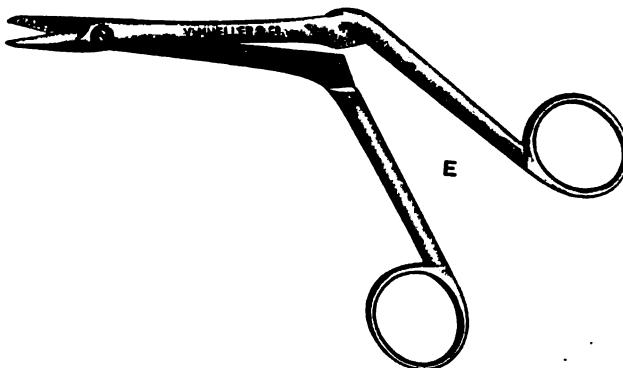


Fig. 2.—The scissors used for cutting spike for removal.

The plates are removed, when union of the septal membranes has taken place, by cutting the tongue of the male plate between the female plate and the septal membrane, after which they can be easily removed with dressing forceps.

**LIST OF FELLOWS OF THE AMERICAN MEDICAL
ASSOCIATION REGISTERED IN THE SECTION
ON LARYNGOLOGY, OTOLOGY AND
RHINOLOGY**

List of Fellows of the American Medical Association who registered in this Section at one or more of the last five Annual Sessions.

The figures following the names indicate the record of attendance at Annual Sessions (4, indicates 1914; 3, 1913; 2, 1912, etc.). Corrections will be appreciated.

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Montgomery, 4.
Rucker, E. W., Jr., 925 Woodward
Bldg., Birmingham, 4.
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ARIZONA

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Bldg., Los Angeles, 1.
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 St., Baltimore, 7, 1, 2, 4.
 Pound, John C., 1300 W. Lombard
 St., Baltimore, 7, 1.
 Reik, Henry Otridge, 506 Cathedral
 St., Baltimore, 6, 7, 8, 9, 2.
 Reik, J. N., 506 Cathedral St., Bal-
 timore, 9, 0, 2, 4.
 Sanger, Frank Dyer, 535 N. Charles
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 Winslow, John R., The Latrobe Apt.,
 Charles and Read Sts., Baltimore,
 7, 9, 4.
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 Emerson, Francis P., 520 Common-
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 Holmes, Edgar M., 531 Beacon St., Boston, 4.
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 Moasher, Harris P., 828 Beacon St., Boston, 4.
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 Canfield, R. Bishop, 300 State St., Ann Arbor, 6, 8, 0, 2, 3.
 Colver, Benton N., 315 Champion St., Battle Creek, 3.
 Cunningham, Henry M., Front and Washington Sta., Marquette, 1.
 Cushman, M. L., Tussing Bldg., Lansing, 0, 2.
 Hickey, Preston M., 32 Adams Ave., W. Detroit, 2, 3, 4.
 Mercer, R. E., Gas Office Bldg., Detroit, 9, 3.
 Miner, Stanley G., 58 Cadillac Square, Detroit, 7, 9, 0.
 Odell, Anna, 32 W. Adams Ave., Detroit, 0, 2, 4.
 Potter, Willis A., Washington Arcade, Detroit, 2.
 Shurly, Burt Russell, 32 Adams Ave., W., Detroit, 7, 8, 9, 0, 1, 2, 3, 4.
 Wilson, Harold, 32 West Adams Ave., Detroit, 4.

MINNESOTA

Beaudoux, Henry A., Lowry Arcade, St. Paul, 3.
 Benham, E. W., Box 55, Mankato, 3.
 Bettingen, J. W., 130 Lowry Bldg., St. Paul, 3.
 Blake, Jas., Hopkins, 3.
 Bockman, Michael W., 404 Pillsbury Bldg., Minneapolis, 3.
 Boeckmann, Egil, 642 Lowry Bldg., St. Paul, 3.
 Brown, Edw. J., 3027 Pleasant Ave., Minneapolis, 3.
 Campbell, Robt. A., 616 Donaldson Bldg., Minneapolis, 3.
 Coulter, Chas. F., Wadena, 3.

Davison, P. C., Clara City, 3.
 Field, Merton, Canby, 3.
 Groves, A. F., Brainerd, 3.
 Hilger, Andrew W., 925 Lowry Bldg., St. Paul, 3.
 Hunt, H. E., 433 Lowry Bldg., St. Paul, 3.
 Johnson, A. Einar, Madison, 2.
 Kohler, Geo. A., 612 Pillsbury Bldg., Minneapolis, 3.
 Lewis, Jos. D., 312 Reid Cor., Minneapolis, 3.
 Matthews, Justus, Rochester, 0, 2, 3.
 Murray, W. R., 621 Syndicate Bldg., Minneapolis, 8, 0, 1, 3, 4.
 Newhart, Horace, Donaldson Bldg., Minneapolis, 9, 0, 3.
 Pake, S. G., 515-16 Fidelity Bldg., Duluth, 3.
 Parker, E. H., Nicollet Ave. and 7th St., Minneapolis, 3.
 Plonske, Chas. J., 412 Masonic Temple, Minneapolis, 3.
 Pratt, F. J., 328 Central Ave., Minneapolis, 1, 2, 3, 4.
 Smith, M. W., Red Wing, 3.
 Stensrud, A. A., Dawson, 3.
 Strathern, F. P., 208 Nassau St., St. Peter, 3.
 Taylor, H. L., 75 Lowry Arcade, St. Paul, 3.
 Tilderquist, D. L., 7 E. Superior St., Duluth, 3.
 Watson, Jas. A., 1034 Andrus Bldg., Minneapolis, 3.
 White, J. S., 744 Lowry Bldg., St. Paul, 3.
 Winter, John A., 503 Fidelity Bldg., Duluth, 3.

MISSOURI

Bardenheier, F. G. A., 430 Frisco Bldg., St. Louis, 0.
 Barnes, Algernon S., Jr., 210 Central Natl. Bk. Bldg., St. Louis, 0.
 Biewerd, E. F., 420 Century Bldg., St. Louis, 0.
 Black, Wm. D., 2925 Geyer Ave., St. Louis, 0.
 Bobbitt, A. N., Frisco Bldg., Joplin, 3.
 Bradley, A. H., 620 Metropolitan Bldg., St. Louis, 0.
 Bryan, Wm. M. C., 306 Humboldt Bldg., St. Louis, 0.
 Creveling, H. Clay, Metropolitan Bldg., St. Louis, 8, 0, 4.
 Dames, Alphonse F., 401 Metropolitan Bldg., St. Louis, 0.
 Gaines, J. W., 1125 Rialto Bldg., Kansas City, 0.
 Goldstein, Max A., 3858 Westminster Pl., St. Louis, 2.
 Guggenheim, L. K., Metropolitan Bldg., St. Louis, 0.
 Gunderlach, C. A., 401 Lister Bldg., St. Louis, 3.
 Hall, D. Walton, 1000 Westover Rd., Kansas City, 5, 8, 0.
 Hall, H. R., 5894 Gates St., St. Louis, 0.
 Howell, J. S., Hannibal, 0.
 James, J. A., 5251 Westminster Pl., St. Louis, 0.

Johnson, W. L., 2144 S. Grand Ave., St. Louis, 0.
 Kempff, Louis A., 2506 N. 15th St., St. Louis, 0.
 Koetter, Albert F., 1023 N. Grand Ave., St. Louis, 0.
 Leavy, C. A., Metropolitan Bldg., St. Louis, 8, 0.
 Loeb, Hanau W., 537 N. Grand Ave., St. Louis, 7, 8, 9, 0, 2, 3.
 Logan, James E., 1208 Wyandotte St., Kansas City, 8, 9, 0, 2.
 Lyman, H. W., 803 Carleton Bldg., St. Louis, 0.
 Miller, H. Edward, Metropolitan Bldg., St. Louis, 0.
 Miller, J. M., Montrose, 8, 0.
 Pfingsten, C. F., Metropolitan Bldg., St. Louis, 0.
 Sauer, W. E., Humboldt Bldg., St. Louis, 7, 8, 0, 1, 2.
 Sawtell, J. E., 702 Waldheim Bldg., Kansas City, 7, 8, 0, 3.
 Scholz, Roy P., Metropolitan Bldg., St. Louis, 9, 0, 3.
 Shapleigh, J. B., Humboldt Bldg., St. Louis, 0.
 Shumate, D. L., 3703 Penn St., Kansas City, 0, 3.
 Simon, F. C., 3515 Dodier St., St. Louis, 0.
 Sluder, Greenfield, 3542 Washington St., St. Louis, 8, 9, 0, 3.
 Spencer, Seldon, 2723 Washington Ave., St. Louis, 0.
 Titworth, Guy, Odd Fellows Bldg., Sedalia, 0.
 Tureman, Herbert, 1102 Rialto Bldg., Kansas City, 0, 4.
 Von der Au, O. L., 2855 S. Jefferson St., St. Louis, 0.
 Wyche, Chas., Humboldt Bldg., St. Louis, 0.

MONTANA

Morse, A. W., 834 Silver St., Butte, 3.
 Potter, Peter, 412 Hennessy Bldg., Butte, 2.

NEBRASKA

Calfas, Wm. F., 567 Brandeis Bldg., Omaha, 3.
 Dayton, Wm. L., 301 Funke Bldg., Lincoln, 3.
 Gafford, C. C., Wymore, 1.
 Kalar, Sara Blaine, Bloomfield, 0.
 Lee, Daniel R., Bridge St., Arcadia, 0.
 Lemere, H. B., 400 Brandeis Theater Bldg., Omaha, 8, 0.
 Owen, F. S., 471 Brandeis Bldg., Omaha, 1, 3.
 Potts, John B., Sanford Hotel, Omaha, 3, 4.
 Sutherland, J. L., 109½ W. 3d St., Grand Island, 3.
 Wherry, W. P., 2444 Manderson St., Omaha, 3.

NEW HAMPSHIRE

Kittredge, F. E., Masonic Temple, Nashua, 6, 9, 4.
 Shedd, J. Z., North Conway, 0, 2, 3.

NEW JERSEY

Adams, Charles F., 52 W. State St., Trenton, 3.
 Ard, Frank C., 604 Park, Plainfield, 4.
 Barkhorn, Henry C., 218 S. Orange St., Newark, 2.
 Chambers, T. R., 15 Exchange Pl., Jersey City, 9, 4.
 Charlton, C. Coulter, 114 S. Illinois Ave., Atlantic City, 4.
 Corwin, T. W., Weiss Bldg., 671 Broad St., Newark, 5, 7, 9, 1, 4.
 Dias, J. Lawrence, Shubert Theater Bldg., Newark, 2.
 Eagleton, Wells P., 212 Elwood Ave., Newark, 6, 7, 1, 2, 4.
 Hemmash, John, 36 Spruce St., Newark, 4.
 Hill, John Augustus, 201, 8th St., Asbury, 4.
 Hirst, Levi B., 586 Federal St., Camden, 9, 2, 4.
 Keefe, Stephen J., 517 N. Broad St., Elizabeth, 2, 4.
 Makuen, G. Hudson, Newfield, 7, 8, 9, 2, 4.
 Pyle, Wallace, 612 Bergen Ave., Jersey City, 2.
 Romine, Geo. L., Lambertville, 7, 9, 2, 4.
 Scarlett, R. B., 78 N. Clinton Ave., Trenton, 9, 2, 4.
 Sheehan, Jos. E., 108 Essex Ave., Orange, 2.
 Upham, Helen F., 305, 3d Ave., Asbury Park, 4.
 Van Horn, Alfred F., 514 Central Ave., Plainfield, 4.
 Wilson, Norton L., 410 Westminster Ave., Elizabeth, 9, 2, 4.
 Young, J. S., 70 Irving St., Raway, 2.

NEW MEXICO

Bullock, Earl S., Silver City, 1.

NEW YORK

Abraham, Jos. H., 130 W. 58th St., New York, 7, 9, 2, 4.
 Banta, Francis M., 706 Riverside Drive, New York, 2.
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 Benedict, A. Judson, 204 Grand St., Newburgh, 2, 4.
 Brown, Clayton M., 510 Delaware Ave., Buffalo, 9, 0, 2, 3, 4.
 Brust, Herbert O., 720 S. Crouse Ave., Syracuse, 4.
 Bryant, W. Sohier, 19 W. 54th St., New York, 5, 6, 7, 8, 9, 0, 2.
 Carter, W. W., 69 W. 50th St., New York, 8, 9, 2, 4.
 Cocks, Gerhard Hutchison, 137 E. 54th St., New York, 2.
 Cott, George F., 1195 Main St., Buffalo, 3, 6, 7, 8, 9, 0, 2, 4.
 Culbert, Wm. L., 16 E. 54th St., New York, 2.
 Curtis, H. H., 118 Madison Ave., New York, 4.
 Davis, George E., 50 W. 37th St., New York, 8, 9, 0.

Dean, J. W., 6 Pine St., Glens Falls, 4.
 Denison, C. E., 143 W. 76th St., New York, 6, 7, 0.
 Duel, Arthur B., 27 E. 57th St., New York, 6, 7, 9, 0.
 Dunning, Wm. M., 391 E 149th St., New York, 4.
 Fairbairn, J. F., 131 Allen St., Buffalo, 8, 9, 4.
 Forbes, Henry H., 40 E. 41st St., New York, 3.
 Forsyth, E. A., 322 Franklin St., Buffalo, 9, 4.
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 Fowler, S. R., 918 University Bldg., Syracuse, 0.
 Freudenthal, W., 1003 Madison Ave., New York, 8, 2.
 Friesner, Isidore, 814 Lexington Ave., New York, 4.
 Fuchsius, John H., 93 Centre Ave., New Rochelle, 2.
 Glogau, Otto, 1320 Madison Ave., New York, 9, 0, 2.
 Grove, Benjamin H., 334 Pearl St., Buffalo, 7, 8, 9, 1.
 Grushlaw, Israel, 154 Henry St., New York, 2.
 Hays, Harold M., 11 W. 81st St., New York, 4.
 Heller, Isaac M., 450 E. Tremont St., New York, 2.
 Herriman, Frank R., 167 Quincy St., Brooklyn, 4.
 Howell, H. P., 39 E. 27th St., New York, 4.
 Hubby, Lester M., 27 W. 68th St., New York, 4.
 Hurd, Lee M., 15 E. 48th St., New York, 2, 4.
 Jarecky, Herman, 138 W. 86th St., New York, 2.
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 King, Jas. J., 40 E. 41st St., New York, 4.
 Kirkendall, John S., 315 N. Aurora St., Ithaca, 5, 7, 9, 4.
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 Leshire, John, 423 Convent Ave., New York, 2.
 Lutz, Stephen Henry, 284 Hancock St., Brooklyn, 6, 9, 2.
 Lynah, Henry L., 24 W. 59th St., New York, 2, 4.
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 McAuliffe, Geo. B., 616 Madison Ave., New York, 4.
 McDonald, Denis J., 117 E. 39th St., New York, 2, 4.
 Meierhof, E. L., 1140 Madison Ave., New York, 8, 2, 4.
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 Mulcahy, Thos. A., 143 W. 92d St., New York, 4.
 Noonan, C. J., 554 Henry St., Brooklyn, 2.
 Oppenheimer, Seymour, 45 E. 60th St., New York, 2, 4.
 Page, John R., 127 E. 62d St., New York, 4.
 Phillips, Wendell C., 40 W. 47th St., New York, 2, 3, 4.
 Roe, John O., 44 Clinton Ave., S. Rochester, 6, 7, 8, 9, 0, 4.
 Root, Wm. W., Slaterville, 4.
 Schoonmaker, P., 86th and Broadway, New York, 7, 1, 4.
 Sheedy, Bryan D., 164 W. 73d St., New York, 9, 0, 2.
 Shirky, G. W., Cornwall-on-Hudson, 8, 9, 0, 2, 4.
 Smith, Harmon, 44 W. 49th St., New York, 4.
 Voislavsky, Antonie P., 122 W. 59th St., New York, 4.
 Voorhees, Sherman, 408 N. Main St., Elmira, 7, 8, 9, 0.
 Waterman, Jas. S., 676 St. Marks Ave., Brooklyn, N. Y., 2, 4.
 Weinstein, Joseph, 261 Central Park W., New York, 2.
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NORTH CAROLINA

Briggs, H. H., 29 Haywood St., Asheville, 8, 9, 2.
 Greene, Jas. B., Medical Bldg., Asheville, 0, 2.
 MacConnell, John Wilson, Hospital Bldg., Davidson, 4.
 Matheson, Jas. P., Charlotte, 4.
 Reaves, W. P., Reaves' Infirmary, Greensboro, 2, 4.
 Russell, E. Reid, Asheville, 4.
 Teague, R. J., Durham, 2, 4.

NORTH DAKOTA

Golseth, Gustave, Jamestown, 3.
 McCannel, A. D., Minot, 3.

OHIO

Alter, F. W., 314 Colton Bldg., Toledo, 2.
 Baron, Frederick S., 511 People Savings Bk. Bldg., Zanesville, 2, 3.
 Bartholomew, A. C., Van Wert, 8, 0.
 Bierkamp, F. J., Dollar Bk. Bldg., Youngstown, 3.
 Burley, S. V., 5th and Broadway, Lorain, 2.
 Carney, Albert C., 111 N. 3d St., Hamilton, 4.
 Chamberlin, Wm. B., 1021 Prospect Ave., Cleveland, 4.
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 Hogue, D. W., Fairbanks Bldg., Springfield, 8, 0, 4.
 Hubbard, Thomas, 2244 Scottwood Ave., Toledo, 2, 3.

Iglauer, Samuel, 3404 Harvey Ave., Cincinnati, 8, 9, 4.
 Large, Secord H., 536 Rose Bldg., Cleveland, 4.
 Lenker, John N., 1021 Prospect Ave., Cleveland, 4.
 Lyne, G. L., Lowell, 4.
 Millette, J. W., 112 Oxford Ave., Dayton, 0.
 Mithofer, William, 22 W. 7th St., Cincinnati, 7, 0, 4.
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 Pennell, William W., Cooper Bldg., Mt. Vernon, 5, 6, 8, 2.
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OKLAHOMA

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OREGON

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PENNSYLVANIA

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 Berens, Bernard, 2041 Chestnut St., Philadelphia, 4.
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 Biedert, Chas. C., 1531 N. 17th St., Philadelphia, 4.
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 Bunting, Josiah T., 6410 Germantown Ave., Philadelphia, 3, 4.
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 Butt, Wm. R., 1701 Chestnut St., Philadelphia, 2.
 Byrne, T. J., 1517 S. Broad, Philadelphia, 9, 2, 4.
 Coates, George M., 1736 Pine St., Philadelphia, 9, 4.
 Corson, G. R. S., 212 W. Market St., Pottsville, 7, 8, 2, 4.
 Cryer, M. H., 1623 Walnut St., Philadelphia, 2.
 Culp, John F., 211 Locust St., Harrisburg, 2, 4.
 Currie, Thos. R., 512 W. Lehigh Ave., Philadelphia, 2.
 Davis, J. Leslie, 1700 Walnut St., Philadelphia, 9, 2, 4.
 Deaver, John B., 1634 Walnut St., Philadelphia, 2.
 Dickinson, B. M., 905 Keenan Bldg., Pittsburgh, 9, 4.

Dyson, John R., 22 N. Church St., Hazleton, 2.
 Evans, Harriet I., 960 Main St., Mahanoy City, 2.
 Eves, Curtis C., 302 S. 19th St., Philadelphia, 4.
 Felt, C. L., 1525 Girard Ave., Philadelphia, 9, 4.
 Fischelis, Philipp, 828 N. 5th St., Philadelphia, 9, 2, 4.
 Fisher, Lewis, 1322 S. 5th St., Philadelphia, 4.
 Gibb, Joseph S., 1804 Chestnut St., Philadelphia, 7, 9, 2.
 Gile, Ben Clark, 2018 Chestnut St., Philadelphia, 2.
 Gleason, E. B., 2033 Chestnut St., Philadelphia, 2, 4.
 Goddard, H. M., 1338 Spruce St., Philadelphia, 2, 4.
 Hall, Wm. D. W., 801 S. 49th St., Philadelphia, 2.
 Hampsy, Alex. R., 2410 Arlington Ave., Pittsburgh, 2, 3.
 Harbaugh, C. H., 1143 S. Broad St., Philadelphia, 4.
 Hargett, Walter S., 5715 Girard Ave., Philadelphia, 2.
 Head, Jos., 1500 Locust St., Philadelphia, 2.
 Heffner, Oliver C., 325 King St., Pottstown, 1.
 Hitschler, William A., 1212 Spruce St., Philadelphia, 7, 9, 2, 4.
 Hoopes, W. H., 7th St., Newport, 2.
 Hunter, Robt. J., 342 N. 63d St., Philadelphia, 4.
 Jackson, Chevalier, Westinghouse Bldg., Pittsburgh, 7, 9, 0, 2, 3.
 Jones, Isaac N., 1831 Chestnut St., Philadelphia, 4.
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 Kehl, Geo. W., 418 N. 10th St., Reading, 2.
 Keller, J. C. Windgap, 4.
 Kirkpatrick, A. B., 1745 N. 15th St., Philadelphia, 9, 4.
 Klopp, E. L., 8th St., Oak Lane, Philadelphia, 9, 2.
 Kneedler, G. C., Jenkins Bldg., Pittsburgh, 1, 2.
 Knorr, John K., Jr., 2235 N. 16th St., Philadelphia, 4.
 Kriebel, E. G., Worcester, 4.
 Kyle, D. Braden, 1519 Walnut St., Philadelphia, 6, 9, 0.
 Laurent, F. Victor, 7140 Jenkins Arcade Bldg., Pittsburgh, 2.
 Lewis, F. O., 261 S. 17th St., Philadelphia, 4.
 MacCracken, Geo. Y., 612 N. 13th St., Philadelphia, 9, 4.
 MacKenzie, Geo. W., 1831 Chestnut St., Philadelphia, 2, 3, 4.
 MacLachlan, A. A., 702 Empire Bldg., Pittsburgh, 9, 4.
 Maine, Chas. L., 116 W. Long Ave., Du Bois, 4.
 Makuen, G. Hudson, 1627 Walnut St., Philadelphia, 7, 8, 9, 2, 4.
 Marshall, Geo. M., 1819 Spruce St., Philadelphia, 7, 9, 2, 4.

McAllister, John C., Ridgway, 7, 8, 0.
 McCready, Jas. H., 816 Empire Bldg., Pittsburgh, 2.
 Mears, D. W., 420 Connell Bldg., Scranton, 6, 7, 9, 2.
 Milligan, Robert, Westinghouse Bldg., Pittsburgh, 4.
 Off, Henry J., 323 S. 20th St., Philadelphia, 4.
 Otto, C. J., 130 N. 7th St., Allentown, 1.
 O'Reilly, Chas. A., 1806 Chestnut St., Philadelphia, 2, 4.
 Packard, P. R., 302 S. 19th St., Philadelphia, 9, 2, 4.
 Parish, Benj. D., 29 S. 19th St., Philadelphia, 9, 2, 4.
 Parrish, Henry, 738 S. 53d St., Philadelphia, 9, 2.
 Patterson, E. J., 1018 Westinghouse Bldg., Pittsburgh, 2.
 Pohl, H. C., W. Center St., Nazareth, 7, 9, 2.
 Pyfer, Howard F., 131 W. Main St., Norristown, 0, 1, 2, 3.
 Reddie, Jacobine S., 880 N. 41st St., Philadelphia, 7, 9, 2.
 Ridpath, Robt. F., 2032 Chestnut St., Philadelphia, 4.
 Rowand, A. H. C., 3704 Spring Garden St., Philadelphia, 9, 2, 4.
 Sandels, C. C., Westinghouse Bldg., Pittsburgh, 9, 0, 2.
 Scheifly, John E., 284 Wyoming Ave., Kingston, 4.
 Sieherling, Geo. F., 956 Hamilton St., Allentown, 2.
 Seifert, F. R., 2202 E. Cumberland St., Philadelphia, 9, 2.
 Shallcross, W. G., 810 Highland Bldg., Pittsburgh, 7, 9, 0, 1, 2, 3.
 Skillern, Ross H., 2030 Chestnut St., Philadelphia, 8, 9, 0, 2, 4.
 Sloan, E. H., Church Ave., Ben Avon, 4.
 Smith, S. MacCuen, 1429 Spruce St., Philadelphia, 7, 9, 0, 2, 4.
 Smock, L. P., 3330 Chestnut St., Philadelphia, 2.
 Somers, Lewis S., 3554 N. Broad St., Philadelphia, 7, 9, 2.
 Stauffer, Nathan P., 4833 Baltimore Ave., Philadelphia, 7, 9, 2, 4.
 Stewart, Harry M., Johnstown Tr. Co., Johnstown, 2.
 Strouse, Frederic M., 2220 N. Broad St., Philadelphia, 9, 2, 4.
 Stout, George C., 1611 Walnut St., Philadelphia, 9, 2.
 Stout, P. Samuel, 4701 Chester Ave., Philadelphia, 9, 4.
 Sullivan, John Jos., Jr., 402 Wyoming Ave., Scranton, 2, 4.
 Turnbull, Thomas, Jr., 835 Western Ave., North Pittsburgh, 7, 9, 2.
 Van Dervoort, C. A., 204 Flanders Bldg., Philadelphia, 2.
 Vansant, Eugene L., 1929 Chestnut St., Philadelphia, 7, 9, 2.
 Wagers, Arthur J., 1517 Walnut St., Philadelphia, 4.
 Warlow, Margaret A., 1718 S. 18th St., Philadelphia, 9, 2.
 Wilson, Samuel M., 1517 Arch St., Philadelphia, 6, 9, 2, 4.

PORTO RICO

Grubbs, S. B., San Juan, 0.

RHODE ISLAND

McLaughlin, Wm. C., 574 Broad St., Providence, 4.
 Porter, Lewis B., 277 Benefit St., Providence, 4.
 Tefft, Benj. F., Jr., 192 Main St., Anthony, 1, 2, 4.

SOUTH CAROLINA

Carpenter, E. W., Main St., Greenville, 4.

SOUTH DAKOTA

Alway, R. D., Aberdeen, 8, 0.
 Hill, L. G., 1st Natl. Bank Bldg., Watertown, 3.
 Parsons, J. G., Lacota Bldg., Sioux Falls, 3.
 Putnam, Edmund D., Sioux Falls, 3, 4.
 Smith, F. C., Cor. Locust and 4th Sts., Yankton, 1, 2.

TENNESSEE

Anderson, E. B., 735 Market St., Chattanooga, 1.
 Cullom, M. M., Wilcox Bldg., Nashville, 2.
 Gillespie, G. B., Covington, 0.
 McKinney, Richmond, Memphis Trust Bldg., Memphis, 8, 0, 4.
 Simpson, W. Likely, Exchange Bldg., Memphis, 4.
 Vaughan, G. E., 334 Franklin St., Clarksville, 7, 8, 0.
 Wood, Hilliard, 309 24th Ave., South Nashville, 2.

TEXAS

Ahlers, O. C., Linz Annex, Sherman, 8, 0.
 Anderson, W. B., Brownwood, 7, 8, 0.
 Aynesworth, Horace T., Provident Bldg., Waco, 4.
 Boyd, Frank D., 302 Hoxie Bldg., Fort Worth, 8, 0, 4.
 Decherd, Henry B., Wilson Bldg., Dallas, 0.
 Foster, J. H., Temple Bldg., Houston, 0.
 Schuster, Michael P., Providence Hospital Bldg., El Paso, 3.
 Warfield, Clarence, Hicks Bldg., San Antonio, 1.

UTAH

Osgood, C. F., 2479 Washington Ave., Ogden, 0.

VERMONT

Griffin, Charles E., 8 West Park Place, Fair Haven, 2, 4.

VIRGINIA

Garrett, J. R., Strickland Bldg., Roanoke, 2, 3.
 Kuyk, Dirk A., 506 E. Grace St., Richmond, 2.
 Miller, C. M., 3 Grace St., Richmond, 9, 0, 2, 4.

WASHINGTON

Cox, W. C., Everett, 1.

WEST VIRGINIA

de Vebre, J. W., Roncevarre, 4.
 Haley, P. A., 108½ Capitol St., Charleston, 2, 3.
 Johnson, H. R., Fairmont, 0, 2.
 Kelly, M. B., 1224 Chapline St., Wheeling, 0, 2.

WISCONSIN

Axtelle, Eugene E., Marinette, 3.
 Boyce, S. R., 215 Pioneer Blk., Madison, 3, 4.
 Coffey, Charles J., Majestic Bldg., Milwaukee, 2.
 Cook, F. S., 53 Ingram Bldg., Eau Claire, 3.
 Dwight, C. G., 215 Pioneer Blk., Madison, 4.
 Higgins, S. G., 1213 Wells Bldg., Milwaukee, 8, 0, 3.
 Pfister, Franz, 1404 Majestic Bldg., Milwaukee, 3.
 Rector, Albert E., 789-91 College Ave., Appleton, 4.
 Wilkowske, C. W., 410 Superior St., Chippewa Falls, 3.

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